RECORDS OF THE AUSTRALIAN MUSEUM

Volume 72 Number 2 24 June 2020

Review of Australian Sarginae Soldier Fly Genera (Diptera: Stratiomyidae), with First Records of *Cephalochrysa*, *Formosargus* and *Microchrysa*

by

Bryan D. Lessard, David K. Yeates, and Norman E. Woodley

A New Genus and Two New Species of Caprellidae (Crustacea: Amphipoda) from Mesophotic and Deep-sea Waters of Australia

by

José M. Guerra-García and Shane T. Ahyong

Volume 72 Number 2

Published (print and online) 24 June 2020
Price: AU$50.00
Printed by Roden Print & Packaging, Sydney

ISSN 0067-1975 (print)
ISSN 2201-4349 (online)

The Australian Museum is a statutory authority of, and principally funded by, the NSW State Government.

[illegible]

[illegible]

[illegible]

Records of the Australian Museum is covered in the Thomson Reuters Scientific services: Current Contents® / Agriculture, Biology, and Environmental Sciences, and Science Citation Index Expanded (also known as SciSearch®).

We promote cross-linking in the scientific literature by using DOI for all Australian Museum scientific publications, article by article back to 1889; metadata in CrossRef® and, from , also in ZooBank. PDF are externally archived at NED (Australia's *National edeposit*). Authors are ORCID® registered.

Records of the Australian Museum (2020)
vol. 72, issue no. 2, pp. 23–43
https://doi.org/10.3853/j.2201-4349.72.2020.1683

Records of the Australian Museum
a peer-reviewed open-access journal
published by the Australian Museum, Sydney
communicating knowledge derived from our collections
ISSN 0067-1975 (print), 2201-4349 (online)

Review of Australian Sarginae Soldier Fly Genera (Diptera: Stratiomyidae), with First Records of *Cephalochrysa*, *Formosargus* and *Microchrysa*

Bryan D. Lessard[1], David K. Yeates[1] and Norman E. Woodley[2]

[1] Australian National Insect Collection,
National Research Collections Australia, CSIRO, PO Box 1700, Canberra ACT 2601, Australia

[2] Department of Entomology, Smithsonian Institution,
c/o 8920 S Bryerly Ct., Hereford, AZ 85615, United States of America

Abstract. A taxonomic treatment to genera is provided for the Australian members of the soldier fly subfamily Sarginae. This includes an updated identification key for the Australian genera, along with the diagnosis and illustration of *Ptecticus* Loew, 1855 and *Sargus* Fabricius, 1798, and three newly recorded genera: *Cephalochrysa* Kertész, 1912 (*Cephalochrysa gselli* (Hill, 1919) comb. nov.), *Formosargus* James, 1939 and *Microchrysa* Loew, 1855. Two new species are also described: *Formosargus melanogrammus* Lessard & Woodley, sp. nov. and *Microchrysa wrightae* Lessard & Woodley, sp. nov. A new Australian record is presented for *Ptecticus longipes* (Walker, 1861), also known from New Guinea and the Solomon Islands, and a taxonomic change is made for *Formosargus lineata* (de Meijere, 1913) comb. nov., from New Guinea, transferred from its previous position within *Chrysochlora* Latreille, 1829. Five genera and 10 species of Sarginae are now recognized from Australia.

Introduction

The Sarginae are a moderate-sized subfamily of soldier flies, with more than 530 species described in 23 genera, distributed on every continent, excluding Antarctica (Woodley, 2001). Prior to this study, the Australian Sarginae comprised only two cosmopolitan genera, *Ptecticus* Loew, 1855 and *Sargus* Fabricius, 1798 (Woodley, 2001). Little is known regarding the biology of the Australian fauna, although sargines from overseas are usually associated with vegetation and have an underappreciated role in decomposition. Adults swarm during mating and can be found on vegetation and flowers (Rozkošný, 1982; Woodley, 2001). Females are usually located near larval food sources and oviposit in decaying fruits, bases of palm leaves and freshly cut logs, whereas males frequent these sites in search of mates (Woodley, 2001). Larvae are often associated with decaying organic matter, including grass, compost heaps (Woodley, 2001) and animal faeces (Rozkošný, 1982).

Woodley (2001) defined the Sarginae as usually slender flies with the antennal flagellum formed of five flagellomeres, with the first four reduced, compact and rounded to form a basal complex, and the apical flagellomere being aristate, and wings with crossvein *m-cu* connected to vein M_4 by presence of dM_{3+4} (previously *bm-cu*; see Lessard *et al.*, 2019). He noted that African and Madagascan flies vary by having additional flagellomeres and by lacking wing vein dM_{3+4} (i.e., Gongrosargus Lindner, 1959; Hauser et al., 2017: 41, fig. 182), leading him to call for a worldwide generic revision. In his phylogenetic hypothesis based on morphology (Woodley, 2001: 17, fig. 1), the Sarginae recovered as sister to the Chrysochlorininae, forming a

Keywords: taxonomy; biodiversity; entomology; Diptera; Stratiomyidae; Sarginae; *Sargus; Ptecticus*
Taxonomic registration: urn:lsid:zoobank.org:pub:184539DF-E8DD-4A48-8E38-70B7860D6134
Corresponding author: Bryan D. Lessard bryan.lessard@csiro.au
Received: 8 March 2019 **Accepted**: 20 February 2020 **Published**: 24 June 2020 (in print and online simultaneously)
Publisher: The Australian Museum, Sydney, Australia (a statutory authority of, and principally funded by, the NSW State Government)
Citation: Lessard, Bryan D., David K. Yeates, and Norman E. Woodley. 2020. Review of Australian Sarginae soldier fly genera (Diptera: Stratiomyidae), with first records of *Cephalochrysa, Formosargus* and *Microchrysa*. *Records of the Australian Museum* 72(2): 23–43.
https://doi.org/10.3853/j.2201-4349.72.2020.1683

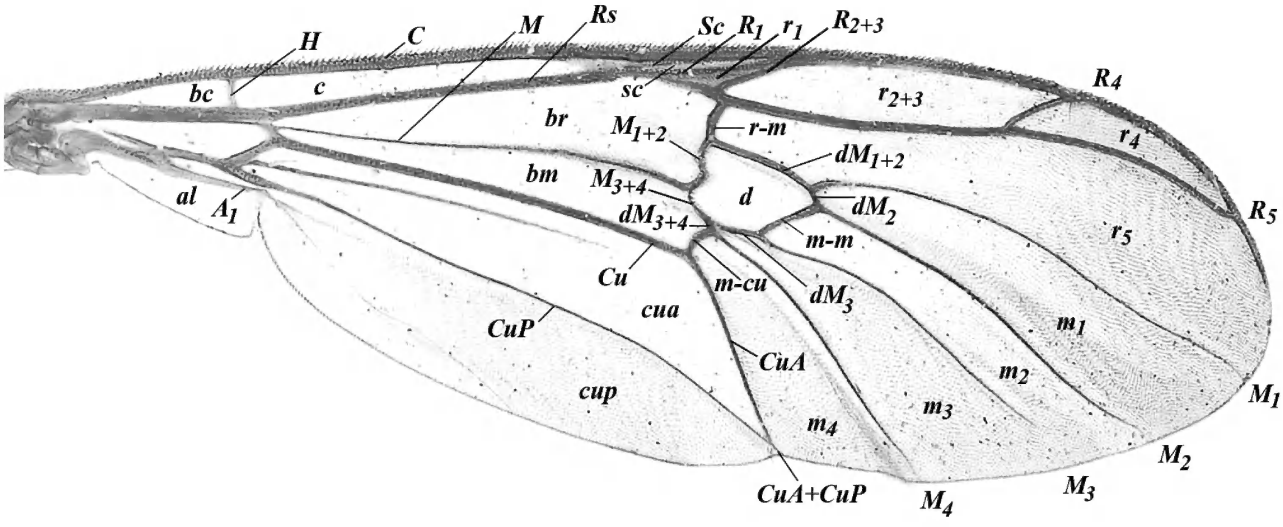

Figure 1. Updated wing terminology of the Stratiomyidae annotated on *Ptecticus rogans* (Walker, 1858), male, dorsal view. Abbreviations: A_1, first branch of anal vein; *al*, alula; dM_{1+2}, discal vein between *r-m* and M_1; dM_2, discal vein between M_1 and M_2; dM_3, discal vein between M_3 and M_4; dM_{3+4}, vein between M_{3+4} and *m-cu*, or *m-cu* and M_4; *bc*, basal costal cell; *bm*, basal medial cell; *br*, basal radial cell; *C*, costal vein; *c*, costal cell; *Cu*, cubital vein; *CuA*, anterior branch of cubital vein; *cua*, anterior cubital cell; *CuA+CuP*, anterior branch of cubital vein + posterior branch of cubital vein; *CuP*, posterior branch of cubital vein; *cup*, posterior cubital cell; *d*, discal cell; *H*, humeral crossvein; *M*, medial vein; M_1, first medial branch; m_1, first medial cell; M_{1+2}, discal vein between *r-m* and *M*; M_2, second medial branch; m_2, second medial cell; M_3, third medial branch; m_3, third medial cell; M_4, fourth medial branch; m_4, fourth medial cell; *m-cu*, medial-cubital crossvein; *m-m*, medial crossvein; R_1, anterior branch of radius; r_1, first radial cell; R_{2+3}, fused second and third radial branch; r_{2+3}, second + third radial cell; R_4, upper third radial branch; r_4, fourth radial cell; R_5, lower third radial branch; r_5, fifth radial cell; *Rs*, radial sector; *r-m*, radial-medial crossvein; *Sc*, subcostal vein; *sc*, subcostal cell.

well-supported monophyletic clade with the Hermetiinae, supported by the morphological characters of the concave posterior surface of the head, elongation of the antepronotum and unarmed scutellum.

The Sarginae appears to be monophyletic in the only molecular study on soldier fly phylogeny, one based on two genes (Brammer & von Dohlen, 2007: fig. 3). In this study, the Hermetiinae, Chrysochlorininae and Sarginae formed a strongly supported monophyletic clade, with the addition of the Nemotelinae which recovered as sister to the Sarginae. In the subsequent morphological analysis of Brammer & von Dohlen (2010: fig. 3), the Sarginae were not monophyletic, instead forming a series of successive clades sister to a larger clade containing Hermetiinae + Clitellariinae (paraphyletic clade 2) + Chrysochlorininae. In the last two studies, only four of the 23 genera of Sarginae were sampled and did not include members from Australia, therefore, the phylogenetic relationships remain unclear for the Australian Sarginae.

The taxonomy of the Australian soldier flies has received little attention and the number of taxonomic treatments for the Sarginae are limited. For the genus *Sargus,* only a handful of publications have each described a single species without providing a clear generic diagnosis (White, 1916; Hill, 1919; Hardy, 1932). The largest revision of Australia sargines was conducted by Daniels (1979) on *Ptecticus* from Australia, New Guinea and the Bismarck and Solomon Islands, with the description of three species from Australia, however, these were later synonymized by Rozkošný & de Jong (2003: 243). Therefore, there is a strong need for a generic revision of the Australian genera.

This paper is part of a recent surge of renewed taxonomic interest revising the genera of the Australian soldier flies (Lessard *et al.,* 2018, 2019, 2020). A taxonomic treatment for the Australian sargines is provided to clarify the generic limits and identification of the regional fauna. An updated key to Australian sargine genera is presented, along with the diagnosis and illustration of the Australian fauna of *Ptecticus* and *Sargus*, and the first Australian records of the newly recorded genera *Cephalochrysa* Kertész, 1912 (*Cephalochrysa gselli* (Hill, 1919) comb. nov.), *Formosargus* James, 1939 (also Oriental) and *Microchrysa* Loew, 1855 (cosmopolitan). Two new species are described: *Formosargus melanogrammus* Lessard & Woodley, sp. nov. and *Microchrysa wrightae* Lessard & Woodley, sp. nov. A new Australian record is presented for *Ptecticus longipes* (Walker, 1861), also known from New Guinea and the Solomon Islands, and a taxonomic change is made for *Formosargus lineata* (de Meijere, 1913) comb. nov., from New Guinea, transferred from its previous position within *Chrysochlora* Latreille, 1829. Five genera and 10 species of Sarginae are now recognized from Australia.

Materials and methods

Specimens were examined using a Zeiss dissecting microscope. Photographs were taken on a Dun Inc. BK Imaging—PLUS Lab System using a Canon 65 mm lens, stacked in Zerene Stacker v. 1.0 software and processed in Adobe Photoshop CS6 to obtain a fully-sharpened image.

Morphological terminology follows Hauser *et al.* (2017), with updated wing venation terminology following Lessard *et al.* (2019) (Fig. 1). Frontal index was calculated by dividing

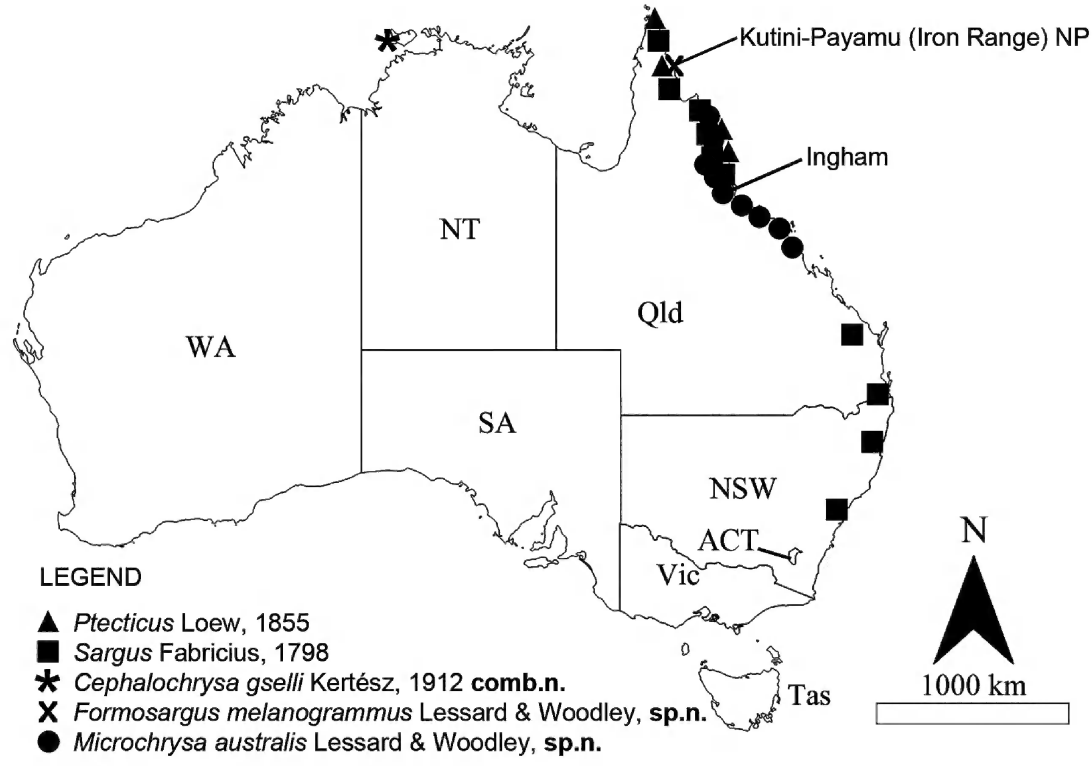

Figure 2. Distribution of the Sarginae from Australia, including the first records of *Formosargus* James, 1939 and *Microchrysa* Loew, 1855. ACT, Australian Capital Territory; NSW, New South Wales; NT, Northern Territory; Qld, Queensland; SA, South Australia; Tas, Tasmania; Vic, Victoria; WA, Western Australia.

the width at the middle of the frons by the distance from the anterior ocellus to the base of antennae (Mason & Rozkošný, 2008). Body lengths are given exclusive of antennae.

Genitalia were prepared by dissecting and incubating the apical portion of the abdomen in KOH at 100°C overnight, followed by a wash in distilled water. After examination in glycerine, the genitalia were transferred to KY jelly and imaged on a Leica M205A microscope and stacked using Helicon Focus 5.3 software. Genitalia were then transferred into glycerine and stored in microvials pinned below each specimen.

Holotype specimen labels are quoted verbatim ("") and individual lines are separated by forward slashes (/). Type specimens were imaged for all genera, excluding *P. longipes* (represented by non-type specimens), and *Ptecticus rogans* (Walker, 1858) (represented by the holotype male and paratype female of the previously synonymized species *Ptecticus queenslandicus* Daniels, 1979; syn. Rozkošný & de Jong, 2003), where type specimens were unavailable for photography. The subfamily and generic diagnoses are given for the Australian fauna only. Collection localities for all species, including novel primary type localities (labelled), are presented in Fig. 2.

The following abbreviations are used in the text: *HT*, holotype; *LT*, lectotype; *PT*, paratype; *NP*, Australian national park; the Australian states New South Wales, Northern Territory and Queensland are NSW, NT and Qld. Geospatial coordinates of certain labels should be read as degrees and minutes not degrees to two decimal places e.g., "15.03S 145.09E" on D. H. Colless labels = 15°03'S 145°09'E. Updates are proposed for insertion into Woodley's (2001) catalogue. Collections and museums are abbreviated as follows:

AMS	Australian Museum, Sydney
ANIC	Australian National Insect Collection, Canberra
BMNH	The Natural History Museum, London
BPBM	Bernice P. Bishop Museum, Honolulu
DEI	Deutsches Entomologisches Institut, Eberswalde
LSL	Collection of the Linnean Society, London
NHNL	National Museum of Natural History Naturalis, Leiden
QM	Queensland Museum, Brisbane
RNH	Nationaal Natuurhistorisch Museum, now in NHNL
SAMA	South Australian Museum, Adelaide
USNM	Smithsonian Institution, Washington
UZMC	Zoologisk Museum, Copenhagen University, Copenhagen
ZMAN	Zoölogisch Museum Amsterdam, now in NHNL

Taxonomy

Subfamily Sarginae

Diagnosis. Small to large flies (length 5–16 mm), usually slender, dull yellowish brown or metallic purplish or greenish blue (Figs 3–14). Head large, wider than thorax, separated from thorax by the well-developed, anteriorly produced antepronotum; occiput strongly concave; eyes usually superficially appearing as bare, with short, relatively sparse hair-like setae visible under higher magnification, occasionally dense, holoptic or narrowly dichoptic in males, dichoptic in females, ommatidia slightly wider anteriorly, with or without distinct demarcation of change in dorsoventral size; ocellar triangle prominent. Males with upper frons narrow, triangular; lower frons diverging or converging ventrally at margins, occasionally bulbous and anteriorly produced; females with narrow to wide

frons (index 1.4–4.8), margins parallel-sided or converging ventrally. Face narrow to wide, rounded and not visible in profile, or with a small, anteroventrally produced, beak-like protuberance that is narrowly visible in profile, usually with a well-defined horizontal impression separating face from ventrally receding oral margins, with two distinct, tentorial pits visible at lateral margins below horizontal impression. Antennae inserted below middle of head, short (equal to length of head) or long (exceeding length of head), scape cylindrical and apically expanded, pedicel sometimes expanded apically on inner surface, flagellum with five flagellomeres, first four flagellomeres compact, rounded and laterally compressed to form an ovoid basal complex, apical margin usually with short, dense, hair-like setae, apical flagellomere aristate, arising anterodorsally from basal complex, usually with two prominent, moderately long, basal hair-like setae. Palpi short, two-segmented, second segment ovoid, often obscured within oral cavity. Proboscis short, labella fleshy. Scutum elongate and slender, about 1.1–1.2 times as long as wide, cuticular surface convex, shining, yellowish brown or strongly metallic bluish purple or greenish, hair-like setae usually dense; scutellum slightly raised or in same plane as scutum, short, about 0.4–0.5 times as long as wide, rounded to almost triangular, posteromedially pointed, unarmed, with hair-like setae; mediotergite well-developed, rounded, subshining, visible in both dorsal and lateral views, usually with some hair-like setae. Legs slender, without significant modification. Wings usually hyaline, occasionally infuscated with brown, set with microtrichia; R_{2+3} arising proximal or distal to *r-m*; R_4 always present; four medial veins strong or faint, terminating before or reaching margin, and issued from discal cell, *m-cu* usually connected to M_4 and separated from discal cell by dM_{3+4}, occasionally connected to discal cell; post-tegula present, with small dorsal tuft of hair-like setae; lower calypter with or without small membranous strap-like lobe at base of wings. Abdomen yellowish brown or metallic bluish purple or green, ovoid (about 1.2–1.4 times as long as wide) or elongate and slender (about 2–3 times as long as wide), with 5 large, well-defined tergites, usually with dense hair-like setae. Females with two segmented cerci.

Remarks. Closely related to the Hermetiinae and Chrysochlorininae, sharing the posterior surface of the head being concave, elongation of the antepronotum, and unarmed scutellum, but distinguished by the combination of the following characters: antennae with five flagellomeres, the apical flagellomere being aristate; wings with M_4 issued separately from discal cell by having *m-cu* connected to M_4.

Included genera. There are currently five Sarginae genera recognized from Australia: *Ptecticus* Loew, 1855 (cosmopolitan), *Sargus* Fabricius, 1798 (cosmopolitan), and the newly recorded genera *Formosargus* James, 1939 (also Oriental), *Cephalochrysa* Kertész, 1912 (cosmopolitan) and *Microchrysa* Loew, 1855 (cosmopolitan) (Woodley, 2001).

Australian distribution of Sarginae. New South Wales, northern NT and Queensland (Fig. 2).

Key to Australian Sarginae genera

1 Wings with R_{2+3} arising proximal to or above *r-m*; membranous strap-like lobe absent at base of wings; yellowish brown flies, usually not metallic 2

—— Wings with R_{2+3} arising distal to *r-m*, usually beyond discal cell; membranous strap-like lobe present at base of wings; metallic flies 3

2 Frons wide and almost parallel in females; face slightly anteroventrally produced to form a small beak-like protuberance visible in profile view; scutum with a distinct black medial vitta; wings with vein *M* weak and nearly unpigmented between cells *br* and *bm*, M_1 and M_3 very weakly developed, M_4 connected to discal cell (i.e. dM_{3+4} absent); alula reduced, almost linear (Fig. 4) ..... *Formosargus* James, 1939

—— Upper frons converging ventrally in females; face evenly rounded in profile view; scutum concolorous yellowish brown (Figs 9, 10) or dully metallic (*P. longipes*; Figs 7, 8), without any distinct markings; wings with vein *M* noticeably pigmented between cells *br* and *bm*, M_1 and M_3 well developed, M_4 separated from discal cell at least slightly by dM_{3+4}; alula large and apically expanded ..... *Ptecticus* Loew, 1855

3 Head anteriorly produced in dorsal view, more circular and less than 1.5 times as wide as high in frontal view; occiput narrowly visible in dorsal view, with a prominent, posteriorly projecting fringe of hair-like setae; frons extremely narrow in females (index > 4), narrowly dichoptic in males by width of anterior ocellus; frontal ocellus distant from posterior ocelli, forming an elongated triangle; wings with all medial veins strong; *CuA* strongly curved, petiole vein *CuA+CuP* relatively long; apical half of alula set with microtrichia; abdomen slender elongate, about twice as long as wide (Figs 11–15) ..... *Sargus* Fabricius, 1798

—— Head anteroventrally compressed in dorsal view, more than twice as wide as high in frontal view; occiput well developed and visible in dorsal view in females, both sexes without an obvious posteriorly projecting fringe of hair-like setae; frons wide in females (index < 2), holoptic in males; ocelli forming an equilateral triangle; wings with at least some faint medial veins; *CuA* relatively straight, petiole vein *CuA+CuP* short; surface of alula bare of microtrichia; abdomen short, broad and ovoid, about 1.2–1.4 times as long as wide 4

4 Small species (length < 6 mm); head more rounded in anterior view, about 0.75 times as high as wide; lower frons without distinct triangular callus; wing cell r_1 stained yellow; all medial veins faint (Figs 5, 6) ..... *Microchrysa* Loew, 1855

—— Medium sized species (length ≥ 6 mm); head dorsoventrally compressed in anterior view, about 0.6 times as high as wide; lower frons with a distinct triangular callus diverging ventrally towards base of antennae; wing cell r_1 stained brown; veins M_2 and M_4 strong (Fig. 3) ..... *Cephalochrysa* Kertész, 1912

Genus *Cephalochrysa* Kertész, 1912

Fig. 3

Cephalochrysa Kertész, 1912: 99. Type species *Sargus hovas* Bigot, 1859, by original designation. See Woodley (2001: 186) for full synonymy.

Diagnosis. Moderately sized (length 7 mm), metallic purplish blue flies, with the occiput well-developed dorsally in females, and ocelli in the form of an equilateral triangle. Regarding the Australian fauna, it is most similar to *Microchrysa,* but can be distinguished by the: larger size; head dorsoventrally compressed in anterior view, about 0.6 times as high as wide; lower frons with a distinct triangular callus diverging ventrally towards base of antennae; basal complex of antennal flagellum somewhat large; and more strongly developed veins M_2, M_3, and M_4.

Distribution. Bathurst Island, NT, **new distribution** (Fig. 2).

Remarks. *Sargus gselli* Hill, 1919 is congeneric with *Cephalochrysa*, sharing the following: head being much wider than high, ocelli forming an equilateral triangle and occiput without a posteriorly projecting fringe of hair-like setae. The general appearance of *S. gselli* is extremely similar to other species of *Cephalochrysa* known from Pacific islands, as well as the type species. Therefore, we transfer this species from its previous position in *Sargus* to become *Cephalochrysa gselli* (Hill, 1919) **comb. nov.**, the first record of *Cephalochrysa* from Australia.

Catalogue of Australian species

Genus *Cephalochrysa* Kertész, 1912

gselli (Hill, 1919) **comb. nov.** NT.
Sargus gselli Hill, 1919: 459. HT ♀ [SAMA 29-003393; missing right wing; Fig. 3]: NT, Bathurst Island. The whereabouts of this specimen was previously unknown (Woodley, 2001: 224).

Genus *Formosargus* James, 1939

Fig. 4

Formosargus James, 1939: 35. Type species *Formosargus kerteszi* James, 1939 [DEI], by monotypy. See Woodley (2001: 190) for full list of synonymy.

Diagnosis. Small (length 5–7 mm), yellowish brown species, similar to *Ptecticus*, but distinguished by the: frons wide and almost parallel in females; face slightly anteroventrally produced to form a small beak-like protuberance that is visible in profile; scutum with a distinct black medial stripe; wings with vein M_1 and M_3 extremely weak and nearly unpigmented between cells *br* and *bm*; M_1 and M_3 very weakly developed; M_4 issued from discal cell (i.e. dM_{3+4} absent); alula reduced, almost linear; and lower calypter linear, without projecting process.

Remarks. Regarding the New Guinean fauna, *Chrysochlora lineata* de Meijere, 1913, is congeneric with *Formosargus*, sharing the characters noted above in the diagnosis. Therefore, we propose moving the species into the latter genus, to become *Formosargus lineata* (de Meijere, 1913) **new combination**.

Distribution. Northern Queensland, **new distribution** record (Fig. 2).

Formosargus melanogrammus Lessard & Woodley, sp. nov.

http://zoobank.org/NomenclaturalActs/05C4A849-BD02-4618-AF2C-2CE8CE515DD5

Fig. 4

Holotype ♀, "Middle Claudie R. / Iron Range N. Qld / 12 Oct.1974 / G. Daniels"; "HOLOTYPE ♀ / *Formosargus melanogrammus* / Lessard & Woodley, 2020" AMS K.478681. The specimen is in excellent condition. **Paratype** ♀, same data as holotype: "PARATYPE ♀ / *Formosargus melanogrammus* / Lessard & Woodley, 2020" AMS K.478682. The specimen is in excellent condition.

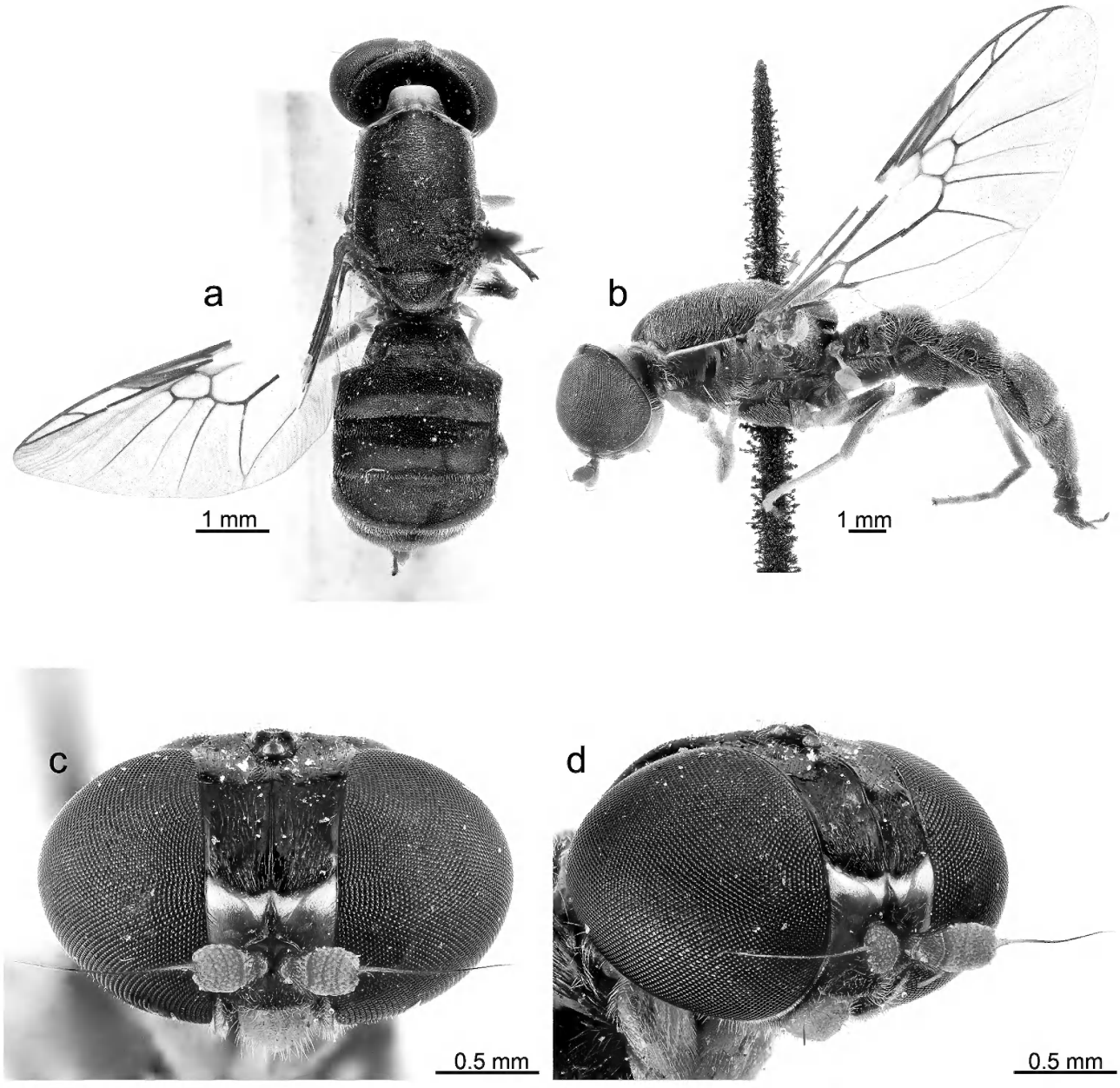

Figure 3. *Cephalochrysa gselli* (Hill, 1919) comb. nov., holotype ♀ (SAMA 29-003393): *(a)* dorsum; *(b)* lateral; *(c)* head, frontal; *(d)* head, anterolateral.

Diagnosis. A small (length 5–7 mm), pale yellowish brown species, with frons wide, parallel-sided, upper half black and lower half pale yellowish cream in the females, and thorax with a distinct dark brownish black medial stripe. It can be distinguished from *Formosargus kerteszi* James, 1939, by the wings with R_{2+3} arising directly in line with crossvein *r-m* (distinctly proximal in *F. kerteszi*), antennal flagellum with a more rounded apical margin of the basal complex and larger fourth flagellomere, scutum and scutellum with a relatively weakly defined black medial stripe (sharply delineated in *F. kerteszi*), and entirely yellowish pleura (a black spot is present on the anepisternum near the notopleural suture in *F. kerteszi*). *Formosargus melanogrammus* is extremely similar to *F. lineata*, differing mainly by having the scutal vitta widened posteriorly and occupying more than one-third of the width of the scutellum (narrower and more sharply defined in *F. lineata*, occupying one-fourth or less of the width of the scutellum). Regarding the Australian sargines, it could possibly be confused with *Ptecticus*, but can be readily distinguished by the generic characters.

Description. *Male*. Unknown.

Female. Length 5–7 mm. **Head**. Rectangular in dorsal view, about 0.4 times as long as wide. Eyes dichoptic, ommatidia uniform in size. Frons wide (index 1.4–1.5), margins parallel-sided, cuticular surface shining, upper half black, slightly raised medially with a linear pale yellowish marking, bare, with moderately long, dense, hair-like setae at lateral margins, lower half pale yellowish cream, cuticular surface relatively convex, bare; ocellar

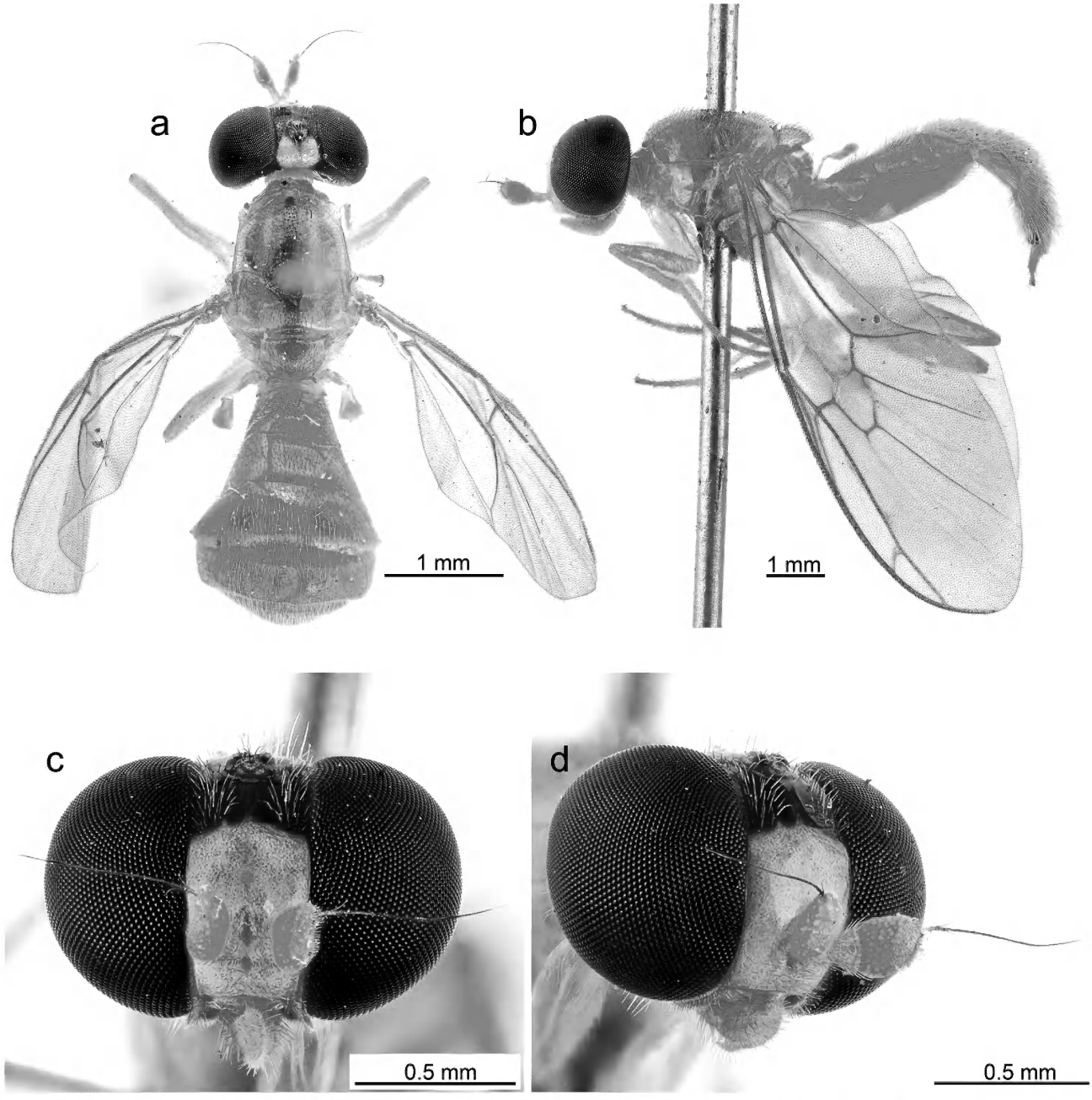

Figure 4. *Formosargus melanogrammus* Lessard & Woodley, sp. nov. holotype ♀ (AMS K.478681): *(a)* dorsum; *(b)* lateral; *(c)* head, frontal; *(d)* head, anterolateral.

tubercle black, ocelli in the form of an equilateral triangle, hair-like setae moderately long and dense, golden yellow. Occiput not visible in lateral view, occipital plate covered in moderately long, dense, golden yellow hair-like setae. Face with cuticular surface shining, with some sparse, moderately long, hair-like setae at lower margins, oral margin with dense, relatively short, golden yellow hair-like setae. Antennae long, scape+pedicel+flagellum about 1.6 times as long as head, pedicel about 0.4 times as long as scape at outer surface, apically expanded and evenly rounded on inner surface, both segments pale yellow, with short, golden brown hair-like setae; flagellum about 1.8 times as long as scape+pedicel, basal complex yellow, apical margin covered with short, relatively dense, yellowish hair-like setae, apical flagellomere long, about 3 times as long as scape+pedicel. Palpi yellow, with tomentum. Proboscis yellowish, with moderately long, dense, yellowish hair-like setae.

Thorax. Scutum pale yellowish brown, with a distinct dark brownish black medial line, hair-like setae moderately long, dense, erect, golden yellow, becoming darker brown dorsomedially; scutellum in same plane as scutum, dark brownish black on more than medial third, pale yellowish brown at lateral margins, hair-like setae moderately long, brown, more yellowish at margins; mediotergite same colour as scutum, with relatively long, erect, golden hair-like setae; pleura pale yellow, shining, hair-like setae relatively long, sparse, golden yellow. Legs pale yellow with yellowish hair-like setae. Wings hyaline; discal cell elongate, about 1.5 times as long as wide; all four medial veins issued from

discal cell, terminating just before margin; *CuA* curved; alula about 6 times as long as wide, surface bare of microtrichia, marginal hair-like setae about equal to width of alula; posttegula with small dorsal tuft of dense, orangey yellow hair-like setae.

Abdomen. Elongate ovoid, about 1.2 times as long as wide, widest at tergite 4, yellowish brown, with darker brown infuscation becoming more prominent from tergites 3 onwards, hair-like setae relative long, dense, appressed golden yellow, becoming longer and more erect at lateral margins. Sternites pale yellowish brown, hair-like setae relatively long, appressed, golden yellow. Terminalia cuticular surface and hair-like setae yellowish brown, cerci with both segments about equal in length, second segment parallel-sided and tapering apically.

Distribution. Known only from the type locality of Kutini-Payamu (Iron Range) NP, northern Qld (Fig. 2).

Etymology. This specific name is derived from the Greek, *melan,* black, and *gramme*, line, referring to the distinctive black medial stripe on the scutum.

Remarks. The face is slightly anteroventrally produced to form a beak-like protuberance, similar to *Hermetia* Latreille, 1804, but not as distinct.

This species is very similar to *F. lineata* (New Guinea), differing mainly in the form of the thoracic vitta. Unfortunately, the wings in the holotype female of *F. lineata* are mostly destroyed, so comparisons of wing characters cannot be made. Also, only females are known for both species so male terminalia characters are also unavailable.

One additional specimen from the Mt Lamond track (♀, "beginning of Mt Lamond track / Iron Range Nat. Park, Qld / 12°43'34"S 143°17'06"E / 3 Jan 1996 20 m / G. and A. Daniels" AMS K.478680) most likely represents an undescribed species as it is larger in size (length 7 mm), and has an incomplete thoracic vitta that is mostly absent anterior to the transverse suture, and abdomen with more defined, almost black markings predominantly on tergites 2 and 3.

Genus *Microchrysa* Loew, 1855

Figs 5, 6

Chrysomyia Macquart, 1834: 262. Type species *Musca polita* Linnaeus, 1758, by designation of Westwood (1840: 130). Suppressed by I.C.Z.N. (1987: 148).

Microchrysa Loew, 1855: 146. Type species *Musca polita* Linnaeus, 1758, by original designation. See Woodley (2001: 202) for full synonymy.

Diagnosis. Small (length 5.0–5.5 mm), partially metallic, sexually dimorphic species, usually with the females having a dark, metallic, concolorous thorax and abdomen, and the males having a pale yellowish abdomen, contrasting with the darker metallic thorax. Most similar to *Cephalochrysa*, but distinguished by the: smaller size; head more rounded in anterior view, about 0.75 times as high as wide; lower frons without distinct triangular callus; and wings with cell r_1 stained yellow and all four medial veins faint.

Remarks. Only two species are recorded from the Australian-Oceanian Region: *M. bipars* (Walker, 1861) [holotype in BMNH, destroyed], from Indonesia (Maluku), and *M. flaviventris* (Wiedemann, 1824) [syntype in UZMC], from Belau, Guam, Indonesia (Papua), Micronesia, New Caledonia, Northern Marianas, Papua New Guinea, Solomon Islands, Vanuatu, and widespread in the eastern Palaearctic and Oriental regions, and recently introduced into the United States of America (Woodley, 2001, 2009).

Distribution. Ranging from far northern Qld to the central coast of NSW, and northern NT (including Rimbija Island), **new distribution** record. See Remarks section of *Microchrysa wrightae* Lessard & Woodley, sp. nov.

Microchrysa wrightae Lessard & Woodley, sp. nov.

http://zoobank.org/NomenclaturalActs/C3A3DED4-14DB-4E3E-8920-4866B5B1939C

Figs 5, 6

Holotype ♂, "Ingham, Qld. / Light Trap / 15 Mar. 1961 / K.I. Harley"; "HOLOTYPE ♂ / *Microchrysa wrightae* / Lessard & Woodley, 2020" ANIC 29-037422. The specimen is in excellent condition. **Paratypes** 13♀♀ [ANIC 29-037423, 29-059047 to 29-059057, 29-059077], same data as holotype: "PARATYPE ♀ / *Microchrysa wrightae* / Lessard & Woodley, 2020"; ANIC 29-059047, 29-059048 and 29-059052 collected 21 Mar.; ANIC 29-059049 and 29-059057 collected by R. Straatman on 20 and 27 Apr., respectively. 16♂♂ [ANIC 29-059032 to 29-059046, 29-037462], same data as holotype: "PARATYPE ♂ / *Microchrysa wrightae* / Lessard & Woodley, 2020"; ANIC 29-059039 collected 5–12 Feb. 1963; ANIC 29-059040 and 29-059042 collected 21 Mar.; ANIC 29-059046 collected 27 Apr. by R. Straatman.

Other material examined: Qld: 1♂ [ANIC 29-059058], 1♀ [ANIC 29-059059], 17.17S 145.34E, Curtain Fig, Feb 1988, D. C. F. Rentz; 1♂ [ANIC 29-059060], 2♀♀ [ANIC 29-059061, 29-059062], Mt. Bartle Frere (East Base), 80 ft, 25 Apr. 1955, Norris & Common; 1♂ [AMS K.453229], Whitfield Range, near Cairns, 3 April 1975, M. S. Moulds; 3♂♂ [ANIC 29-059065, 29-059066, 29-059068], Ayr, 12-10-1950, E. F. Riek; 1♂ [ANIC 29-059067], same data as previous, 11-10-1950; 1♀ [ANIC 29-059070], same data as previous, 4-9-1950; 1♀ [ANIC 29-059072], same data as previous, 12-10-1950; 2♀♀ [ANIC 29-059069, 29-059071], Ayr, 30.ix.1960, R. Hughes; 3♂♂ [AMS K.453218–K.453220], 2♀♀ [AMS K.453216, K.453217], 15.50S 145.20E, 3 km N of Bloomfield, 21 Sep 1992, at light, P. Zborowski & L Miller; 1♂ [ANIC 29-059073], 3 mls W of Mossman, 13 Mar 1964, I. F. B. Common & M. S. Upton; 1♀ [AMS K.453224], Windsor Tableland, NW of Mossman, 810 m, 16°12'51"S 145°0.4'09"E, 4 Jan 1994, site 1, G. & A. Daniels, R. Eastwood mv lamp; D. H. Colless, at light: 1♀ [ANIC 29-059063], 15.04S 145.145.07E, Mt Webb Nat Pk, 29 Apr 1981; 1♀ [ANIC 29-059064], 15.03S 145.09E, 3 km NE of Mt Webb, 1 May 1981; 1♂ [ANIC 29-059074], 12 km SE of Daintree, 22 Nov 1981; 2♂♂ [ANIC 29-059075, 29-059076], 17.20S 145.31E, Wongabel State Forest, nr Atherton, 18 Nov. 1981; 2♂♂ [ANIC 29-059078, 29-059079], 15.50S 145.20E, Gap Ck, 5 km ESE Mt Finnigan, 14 May 1981; 1♂ [ANIC 29-059080], 15.29S 145.16E, Mt Cook Nat Park, 10 May 1981; 1♂ [ANIC 29-059082], 16.30S 145.00E, McLeod R., 14 km W by N of Mt. Carbine, 23 Nov 1981; 1♀ [ANIC 29-059081], 15.49S 145.14E, Little Forks Annan River, 18 Oct 1980, D. H. Colless, Malaise trap.

Diagnosis. A small (length 5.0–5.5 mm) species, with metallic golden or purplish green thorax, pale yellow legs with a dark brown marking on the apical half of the hind tibiae, and antennae and palpi yellow in males, darker brown in females. This species can be distinguished from *M. flaviventris* by the abdomen without green colouration in males (tergite 5 with green colouration in *M. flaviventris*), and both sexes

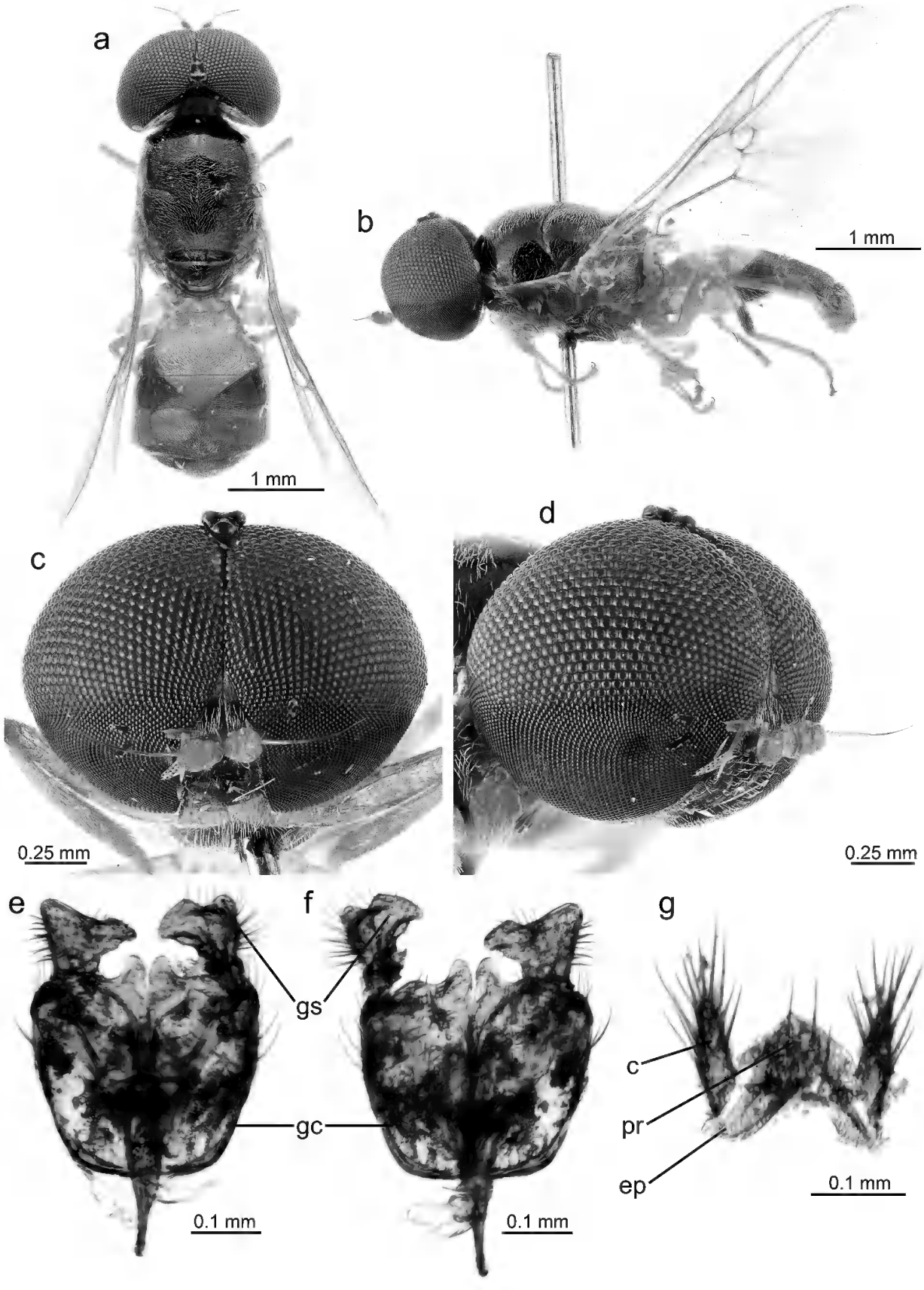

Figure 5. *Microchrysa wrightae* Lessard & Woodley, sp. nov. holotype ♂ (ANIC 29-037422): *(a)* dorsum; *(b)* lateral; *(c)* head, frontal; *(d)* head, anterolateral; paratype ♂ (ANIC 29-037462): (e) genital capsule and phallic complex, dorsal; (f) genital capsule and phallic complex, ventral, and; (g) epandrium, proctiger and cerci, dorsal. Abbreviations: *c*, cercus; *ep*, epandrium; *gc*, gonocoxite; *gs*, gonostylus; *pr*, proctiger.

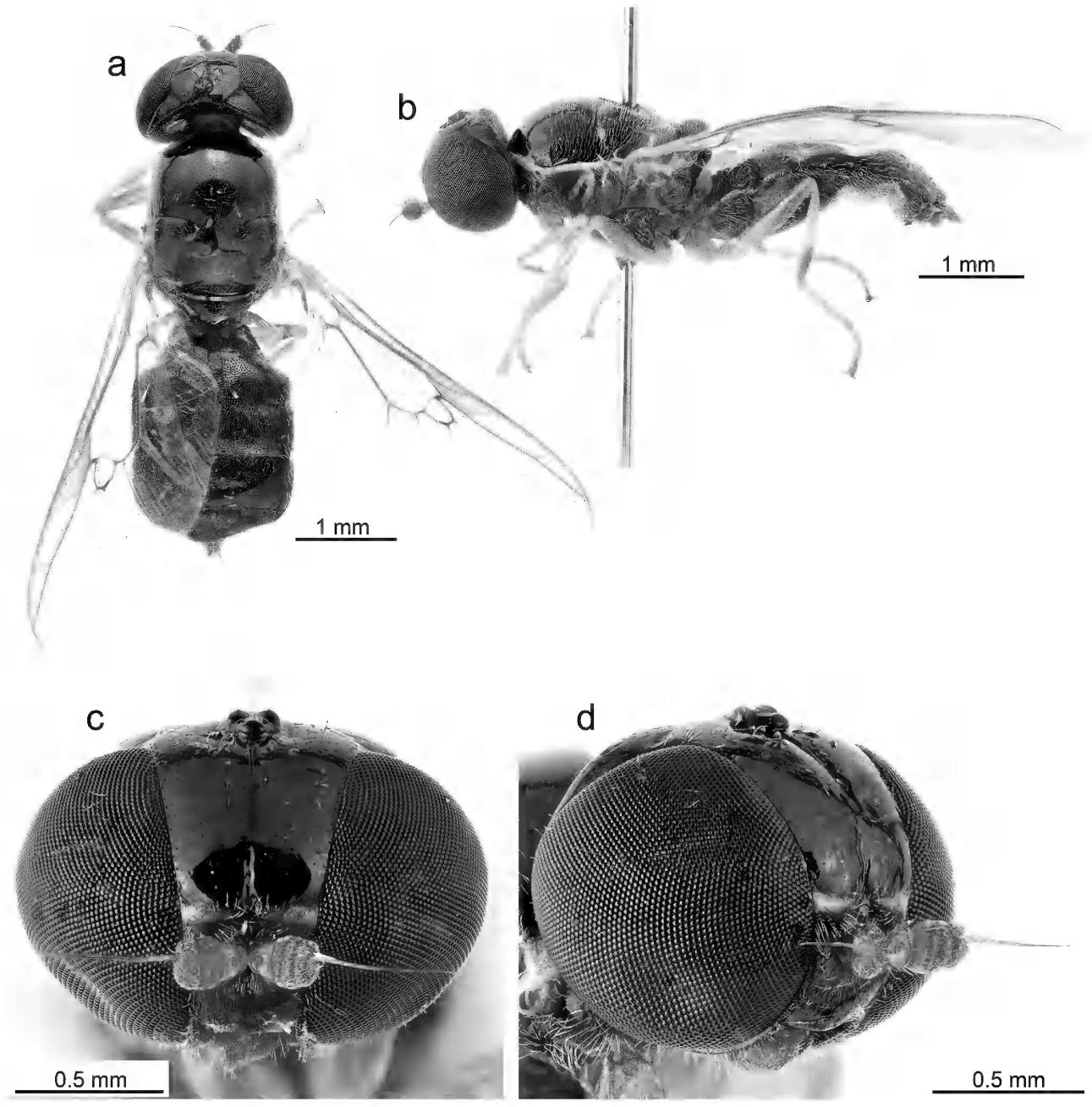

Figure 6. *Microchrysa wrightae* Lessard & Woodley, sp. nov. paratype ♀ (ANIC 29-037423): *(a)* dorsum; *(b)* lateral; *(c)* head, frontal; *(d)* head, anterolateral.

with anterior portion of discal cell between *r-m* and M_1 well developed and distinctly visible (faint in *M. flaviventris*; Woodley 2009), and hind femora entirely yellow (marked with dark brown apically in *M. flaviventris*), and the male terminalia with the posterior margin of the synsternite with a bilobed process with the lobes narrowly separated (deeply emarginate in *M. flaviventris*; Nagatomi 1975: fig. 4B).

Description. *Male*. Length 5.0–5.5 mm. **Head**. Eyes holoptic, contiguous about one-third the length of frons from vertex, with distinct demarcation of change in size of ommatidia just above antennae. Upper frons blackish, bare, lower frons diverging ventrally at margins, with a distinct linear impression, cuticular surface subshining, upper half pale brown, lower half black, hair-like setae relatively short, dense, golden; ocellar tubercle relatively bulging at each ocellus, ocelli almost in the shape of an equilateral triangle, slightly elongated anteriorly, black with reflections of green, hair-like setae relatively short, yellowish. Occiput not visible in lateral view, occipital plate relatively bare, with short, yellowish hair-like setae limited to lateral margins. Face wide, narrowly visible in profile, shining metallic green and gold, hair-like setae relatively short, dense, golden yellow. Antennae relatively s, scape+pedicel+flagellum about equal to length of head, scape about equal to length of pedicel, pedicel slightly expanded and curved gently apically on inner surface, both segments pale yellow, flagellum basal complex yellow, with small, irregular, circular presumably sensory pits, apical margin with short, golden hair-like setae, apical flagellomere yellowish brown, about 1.7 times as

long as scape+pedicel. Palpi very short, yellow, with short, yellowish hair-like setae. Proboscis yellowish, with short, yellowish hair-like setae.

Thorax. Scutum shining metallic golden green, occasionally with purplish reflections, with relatively short, dense, appressed, golden hair-like setae; scutellum slightly raised relative to scutum, same colour as scutum, with relatively short, dense, golden hair-like setae; mediotergite same colour as scutum, with a few moderately long, golden hair-like setae; pleura brownish with reflections of green to gold, with a prominent, narrow, whitish horizontal strip encompassing postpronotal lobe and upper margin of anepisternum, hair-like setae pale yellow to whitish. Legs with pale yellow coxae, femora, tibiae and tarsi, brown on apical half of hind tibiae, hair-like setae pale yellowish on all segments. Wings hyaline; cell r_1 stained entirely pale yellow; R_{2+3} arising distal to *r-m,* exceeding length of discal cell; discal cell small, slightly elongate, about 1.3 times as long as wide; all medial veins terminating before reaching margin, M_1 and M_3 the weakest, both occasionally reduced to appendices or appearing as absent, M_4 issued separately from discal cell by dM_{3+4}; *CuA* relatively straight, curving at extreme end toward margin, petiole vein *CuA+CuP* short; alula large, slightly expanded and relatively pointed apically, surface without microtrichia; post-tegula yellowish, with yellowish hair-like setae; lower calypter with small strap-like lobe present, hair-like setae dense, relatively long, pale golden yellow.

Abdomen. Ovoid, about 1.2–1.4 times as long as wide, tergites 3–5 relatively quadrate, widest at tergite 5, cuticular surface pale yellow, contrasting with golden green thorax, hair-like setae short, dense, appressed, brown, becoming more yellow and erect at lateral margins, most obvious on tergites 2, 3 and apical margins of tergite 6. Sternites pale yellow, hair-like setae short, dense, appressed and entirely golden yellow. Terminalia yellowish brown: gonostyli semi-triangular, relatively acutely pointed posterolaterally, with a depressed groove at centre, hair-like setae relatively long, dense, brownish; gonocoxites nearly quadrate, evenly tapered anteriorly, posterior margin of genital capsule emarginate with a pair of rounded sublateral processes separated by a deep, quite narrow emargination, gonocoxal apodemes relatively short, not reaching anterior margin, anteriorly pointed; epandrium relatively short, anterior margins blunt, rounded laterally, proctiger wider than long, semi-triangular, cerci longer than wide, rounded at tip, exceeding length of proctiger, hair-like setae long, dense, brownish.

Female. Length 5.0–5.5 mm. Similar to males, but slightly more bluish purple in colouration on the thorax and the abdomen, abdomen is concolorous with the scutum. Eyes with ommatidia of uniform size, with extremely sparse, short, whitish hair-like setae. Frons wide (index 1.4–1.5), with a strong medial impression, margins converging ventrally, shining metallic purplish to aqua blue, with relatively sparse, short, dull yellowish white setae, lower frons with a pale yellowish brown horizontal band. Occiput well developed, shining metallic purplish to aqua blue, dorsal half visible in lateral view. Antennae darker yellowish brown. Palpi dark brown. Abdomen with tergites blackish with strong reflections of green to purplish blue, concolorous with thorax, lateral hair-like setae whitish; sternites dark brown to black, with subtle bluish reflections, hair-like setae whitish.

Distribution. Northern Qld (Fig. 2).

Etymology. This specific name is in honour of Susan Wright, Collection Manager of Entomology, QM, for assistance and access to the collection.

Remarks. At least four undescribed species of *Microchrysa* are known in collections from: *(a)* Pine Creek and Curtain Fig, Qld [ANIC 29-059299 to 29-059301]; *(b)* Townsville to Brisbane, Qld [7♂♂ ANIC 29-059289, 29-059290, 29-059291, 29-059292, 29-059293, 29-059295, 29-059298; 3♀♀ ANIC 29-059291, 29-059294, 29-059295; 1♀ AMS K.453226, 3♂♂ AMS K.453230–K.453232; 1♀ USNM; 2♂♂ QM] and Carnarvon Golf Club, NSW [9♀♀ AMS K.478683–K.478691]; *(c)* Davies Creek, Qld, [N.E. Woodley Collection donated to USNM]; and *(d)* Kutini-Payamu (Iron Range) National Park [AMS K.453227, K.453225]. Material is also known from Berry Springs, Larrakeyah, Casuarina Point, Black Point, and Rimbija Islands, NT, that superficially resemble *M. wrightae*.

Although little is known regarding the biology of the Australian sargine fauna, this genus appears to be associated with vegetation, based on collection labels of specimens belonging to three undescribed species: two specimens from Brisbane (AMS K.453231, K.453232) were collected from leaves of *Physallis peruviana* (Solanaceae); a series of females from Carnarvon Golf Club, NSW (AMS K.478683–K.478691) were collected from a woodchip pile, and; a female from Snake Bay (presumably NT; ANIC 29-059096) and male from Melville Island (NT, ANIC 29-059101) were collected from the native shrub *Opilia amentacea* (Opiliaceae).

Genus *Ptecticus* Loew, 1855

Figs 7–10

Ptecticus Loew, 1855, p. 142. Type species *Sargus testaceus* Fabricius, 1805, "Sierra Leon" [UZMC], by original designation. See Woodley (2001: 208) for full synonymy. Daniels (1979: 565, revision of Australian species).

Diagnosis. Medium to large (length 8–16 mm), slender, yellow to orange brown flies, similar to *Sargus*, but distinguished by the: antennal scape strongly, more or less triangularly produced into flagellar complex on inner side (e.g., Fig. 10d); wings with R_{2+3} arising proximal to *r-m*; lower calypter without strap-like lobe; and usually not strongly metallic in colouration (only one species, *Ptecticus longipes* (Walker, 1861), new record, is semi-metallic: Figs 7, 8). Regarding the Australian fauna, the genus is most similar to *Formosargus*, but can be distinguished by the: upper frons converging ventrally in females; face evenly rounded in profile view; wings with M_1 and M_3 well developed, M_4 separated from discal cell at least slightly; and alula large and apically expanded.

Distribution. Northern Queensland (Fig. 2).

Remarks. Rozkošný & de Jong (2003) synonymized the species proposed by Daniels (1979): *Ptecticus albitarsus* Daniels, 1979: 574 (= *quadrifasciatus* Walker, 1860), *Ptecticus amplior* Daniels, 1979: 581 (= *complens* Walker, 1858) and *P. queenslandicus* (= *rogans* Walker, 1858; Daniels, 1979: 580).

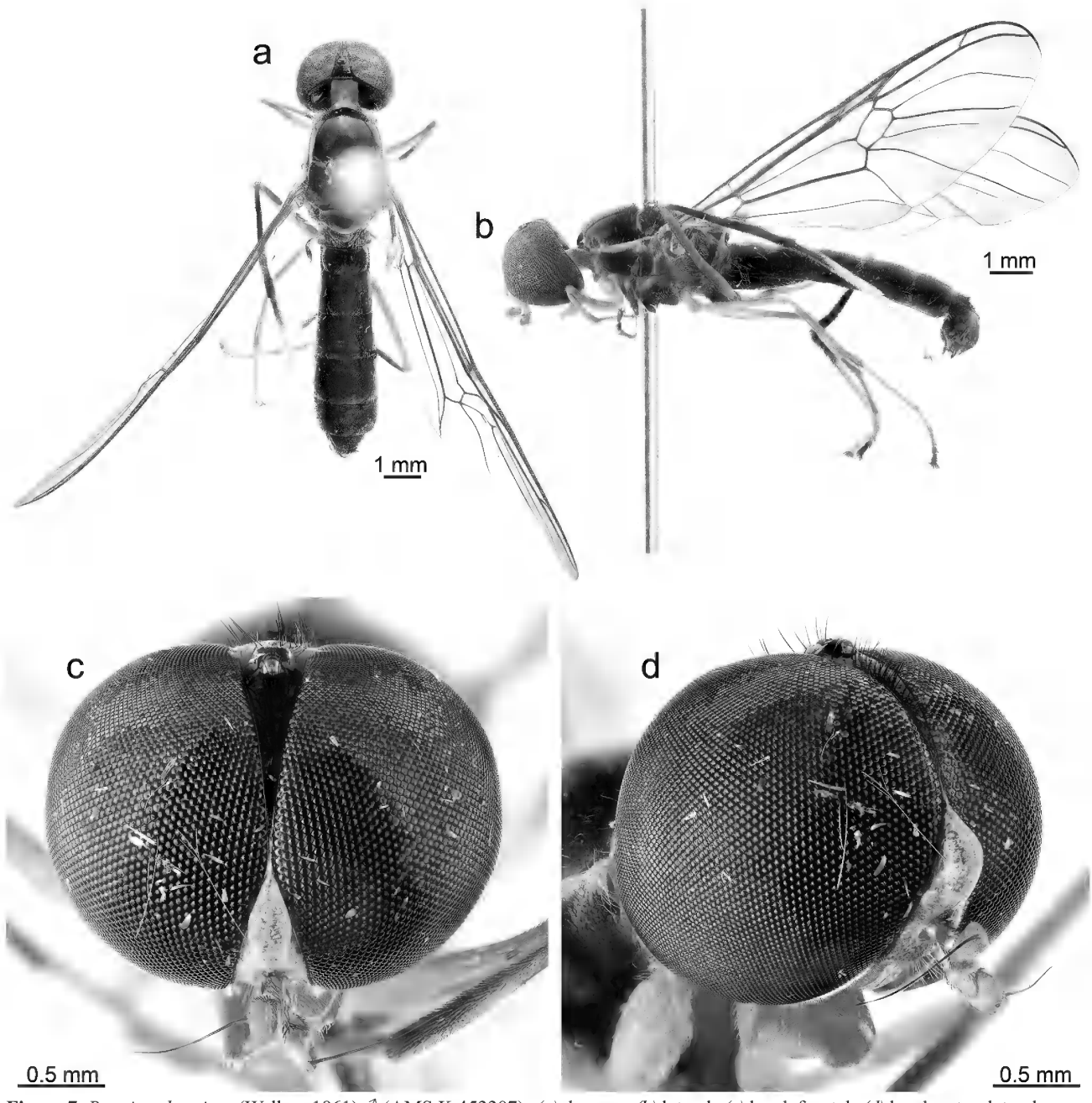

Figure 7. *Ptecticus longipes* (Walker, 1861) ♂ (AMS K.453307): *(a)* dorsum; *(b)* lateral; *(c)* head, frontal; *(d)* head, anterolateral.

Here we present the first Australian records for *P. longipes* (previously recorded from Indonesia, New Guinea, Solomon Islands) from a series of specimens collected from King Park, Kutini-Payamu (Iron Range) NP, Qld (males and females AMS K.453305–K.453309). This is the only Australian species exhibiting semi-metallic colouration, having a deep milky blue thorax and abdomen. It is likely to be confused with *Sargus*, but can be readily distinguished based on the generic characters.

Little is known regarding the biology of the Australian species, however, Woodley (2001) noted that some species were associated with fallen fruits in the forests of Panama, and decaying piles of grass and compost heaps in the United States of America.

Catalogue of Australian species

Genus *Ptecticus* Loew, 1855

complens (Walker, 1858). Australasian: Australia (Qld), Indonesia (Irian Jaya, Maluku), Papua New Guinea (Papua New Guinea). Oriental: Indonesia (Sulawesi), Philippines.

Sargus complens Walker, 1858: 81. HT ♂ (stated ♀) [BMNH]: Indonesia: Maluku, Kepulauan Aru.

Sargus repensans Walker, 1859: 96. HT ♂ [BMNH]: Indonesia: Sulawesi, Ujung Pandang. Syn. by Mason & Rozkošný (2005b: 440).

Sargus tarsalis Walker, 1861b: 274. HT ♀ [BMNH, destroyed]: Indonesia: Maluku, Pulau Bacan. Syn. by Rozkošný & de Jong (2003: 243).

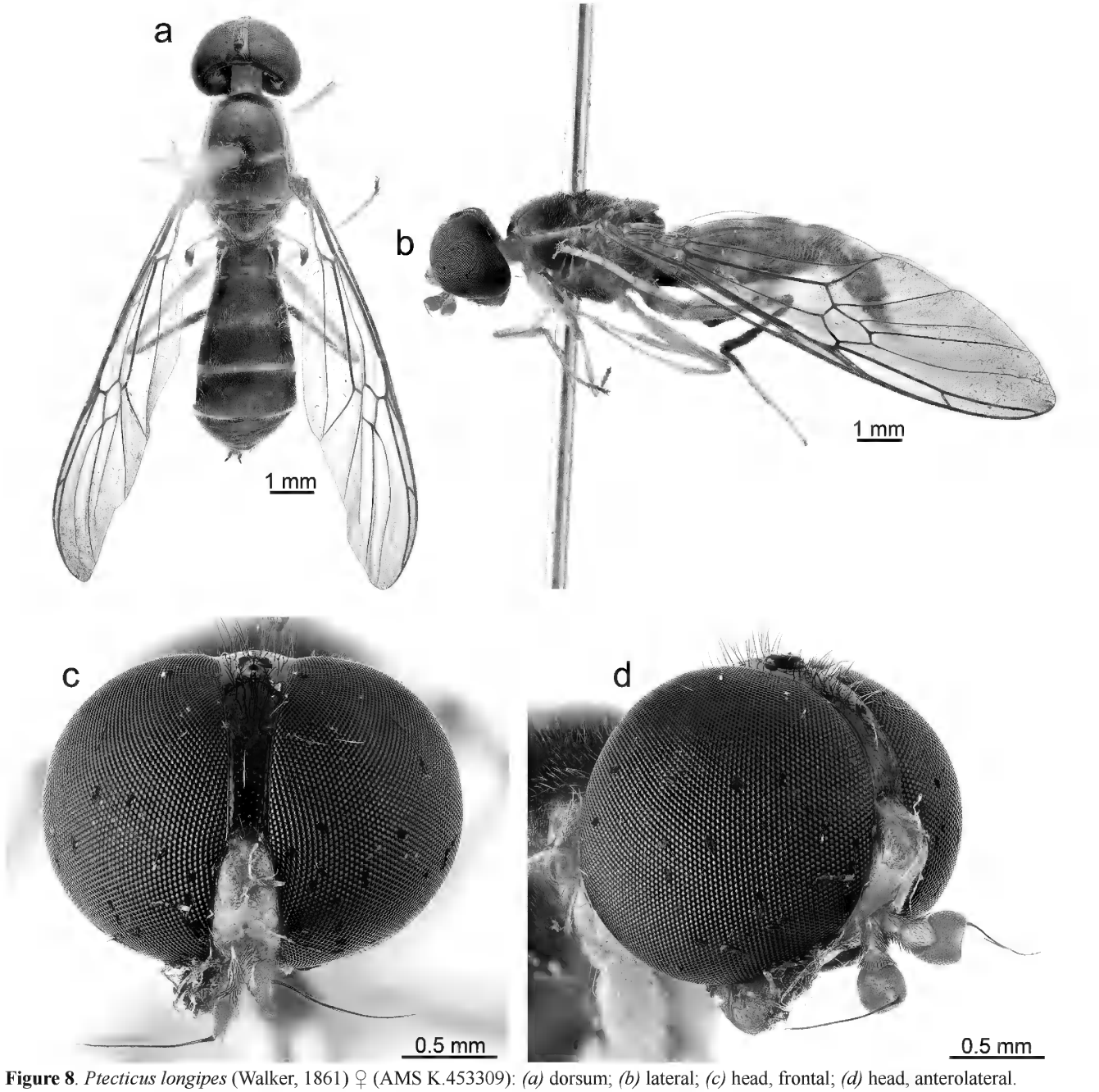

Figure 8. *Ptecticus longipes* (Walker, 1861) ♀ (AMS K.453309): *(a)* dorsum; *(b)* lateral; *(c)* head, frontal; *(d)* head, anterolateral.

Sargus rufescens Wulp, 1869: 104. LT ♀ [NHNL(RNH), des Rozkošný & de Jong 2003: 245]: Indonesia: Maluku, Halmahera.

Sargus rubescens.—Bigot, 1891: 280. Incorrect subsequent spelling.

Ptecticus repensans ssp. *anneliesae* Lindner, 1935: 48. HT ♀ [location of type unknown]. Indonesia: Sulawesi, Ile-Ile, 500–800 m. See Mason & Rozkošný (2005b: 442).

Ptecticus repensans ssp. *monticola* Lindner, 1935: 48. ST ♂ [location of type unknown]. Indonesia: Sulawesi, Bantimoeroeng. See Mason & Rozkošný (2005b: 442).

Ptecticus amplior Daniels, 1979: 581. HT ♂ [AMS]: Australia: Queensland, Middle Claudie River. Syn. by Rozkošný & de Jong (2003: 243).

longipes (Walker, 1861a) **new distribution**. Australasian: Australia (Qld), Indonesia (Irian Jaya, Maluku), Papua New Guinea (Papua New Guinea).

Sargus longipes Walker, 1861a: 232. HT ♀ (stated ♂) [BMNH: Figs 7, 8]: Indonesia: Irian Jaya, Dorey. Moved from *Sargus* to *Ptecticus* by Woodley (2001: 213). New record for Australia.

Sargus tibialis Walker, 1861b: 273. HT ♂ [BMNH]: Indonesia: Maluku, Pulau Bacan.

quadrifasciatus (Walker, 1860). Australasian: Australia (Qld), Indonesia (Irian Jaya, Maluku), Papua New Guinea (Bismarck Archipelago, Papua New Guinea). Oriental: Indonesia (Sulawesi).

Sargus quadrifasciatus Walker, 1860: 145: 145. HT ♂ [BMNH, destroyed]: Indonesia: Maluku, Pulau Ambon.

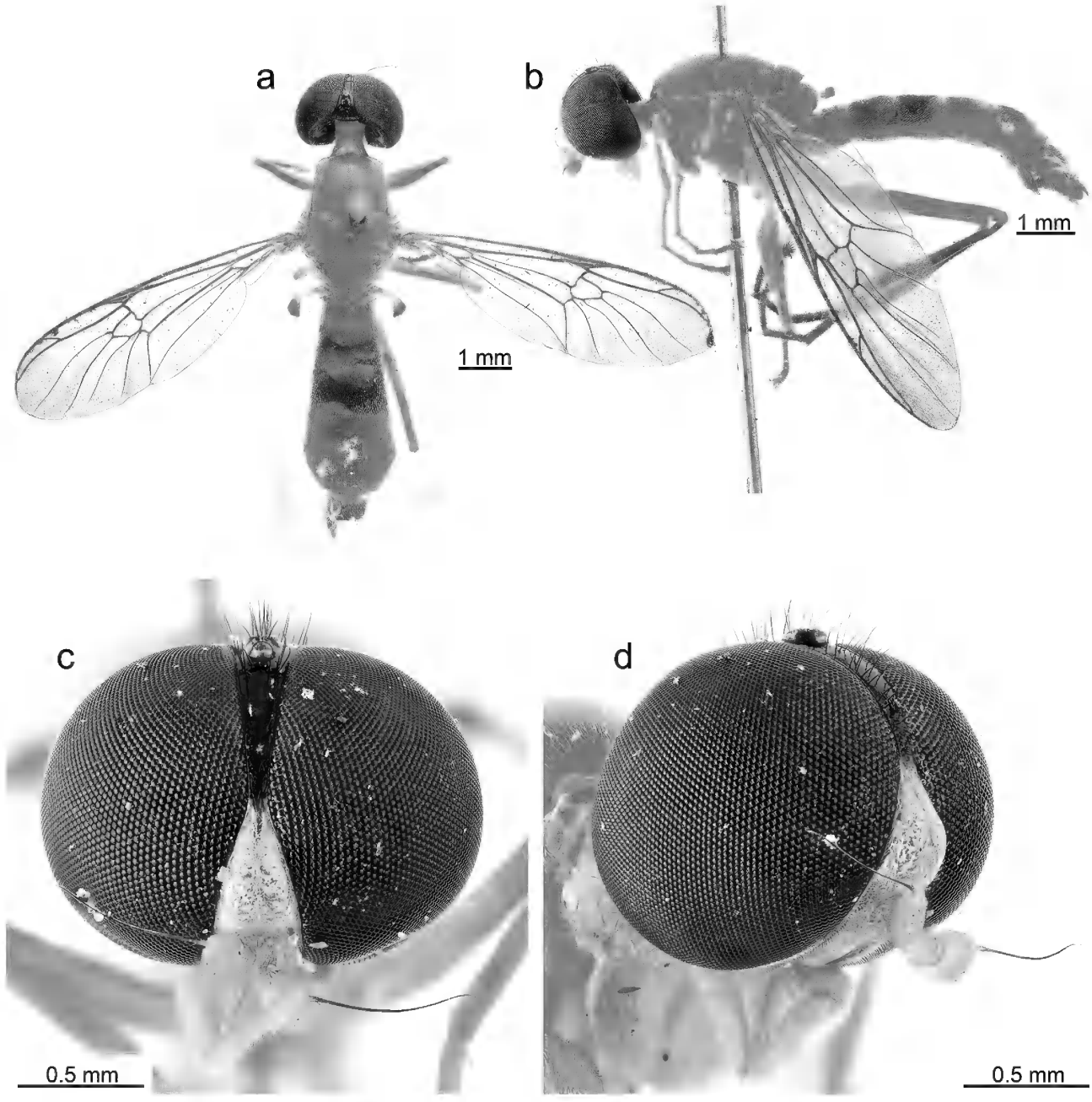

Figure 9. *Ptecticus queenslandicus* Daniels, 1979 holotype ♂ (= *rogans* Walker, 1858: syn. Rozkošný & de Jong 2003) (AMS K.70681): *(a)* dorsum; *(b)* lateral; *(c)* head, frontal; *(d)* head, anterolateral.

Ptecticus albitarsis de Meijere, 1913: 319. HT ♂ [NHNL(ZMAN)]: Indonesia: Irian Jaya, Alkmaar.
Ptecticus albitarsus.—Daniels, 1979: 574. Incorrect subsequent spelling.

rogans (Walker, 1858). Australasian: Australia (Qld), Indonesia (Irian Jaya, Maluku), Papua New Guinea (Papua New Guinea). Oriental: India, Philippines.
Sargus rogans Walker, 1858: 81. LT ♀ [BMNH, des. Rozkošný & de Jong 2003: 256; Figs 9, 10]: Indonesia: Maluku, Kepulauan Aru.
Plecticus doleschalii Bigot, 1879: 231. HT ♂ [BMNH]: Indonesia: Irian Jaya, Pulau Misool.
Ptecticus doleschallii.—Wulp, 1896: 50. Incorrect subsequent spelling.
Ptecticus doleschalli.—Wulp, 1898: 411. Incorrect subsequent spelling.
Ptecticus queenslandicus Daniels, 1979: 580. HT ♂ [AMS]: Australia: Qld, Middle Claudie River. Syn. by Rozkošný & de Jong (2003: 255).

Key to Australian species

A recent key to the Australasian species was presented in Rozkošný & de Jong (2003: 257).

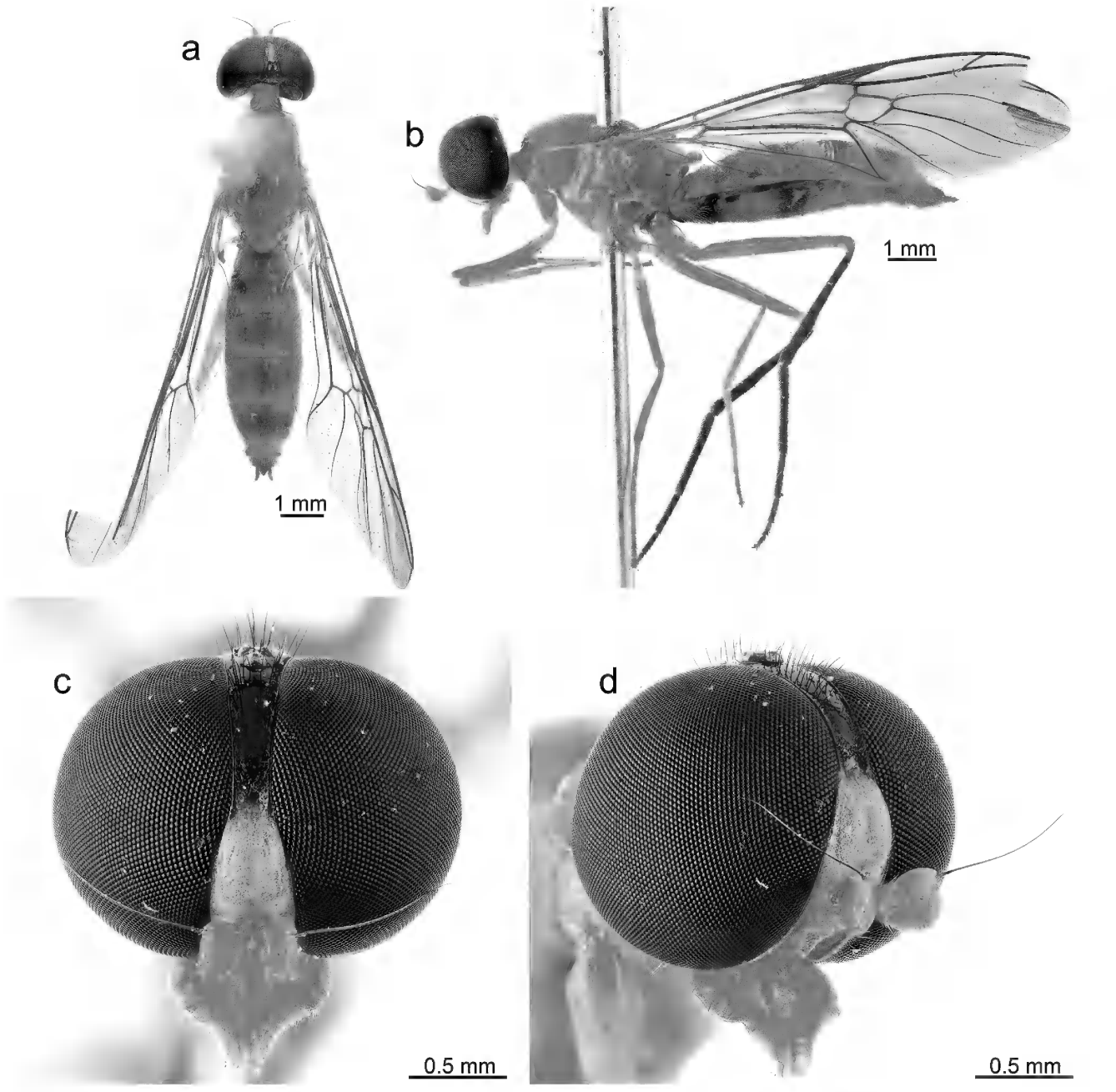

Figure 10. *Ptecticus queenslandicus* Daniels, 1979 paratype ♀ (= *rogans* Walker, 1858: syn. Rozkošný & de Jong 2003) (AMS K.364669): *(a)* dorsum; *(b)* lateral; *(c)* head, frontal; *(d)* head, anterolateral.

Sargus Fabricius, 1798

Figs 11–15

Sargus Fabricius, 1798: 549. Type species *Musca cupraria* Linnaeus, 1758, Europe, [LSL], by designation of Latreille (1810: 442). See Woodley (2001: 220) for full synonymy. Hardy (1918: 11, 1920: 48, 1932: 47); White (1916: 94).

Diagnosis. Small to medium sized (length 6–12 mm), slender, elongate species, with strong metallic colouration and occiput with a prominent fringe of posteriorly directed hair-like setae. Similar to *Ptecticus*, but distinguished by the: anterior ocellus farther from posterior ocelli than they are from each other, forming an elongated triangle; wings with vein R_{2+3} arising distal to *r-m*; lower calypter with strap-like lobe present; and strong metallic colouration.

Distribution. Far northern Qld to central coast of NSW (Fig. 2).

Remarks. With the transfer of *C. gselli* from *Sargus* to *Cephalochrysa*, there are now three recognized species of *Sargus* from Australia. According to White (1916), *Sargus* was previously unrecorded from Australia at the time, with *Sargus meridionalis* White, 1916 being the first species recognized from the continent. This was reinforced by Hill (1919: 460) in his description of *S. gselli* (= *C. gselli*), stating that *Sargus* "has been known in Australia by only one described species, *S. meridionalis* White. There are

Figure 11. *Sargus mactans* Walker, 1859 holotype ♂ (BMNH: NHMUK010922300): *(a)* dorsum; *(b)* lateral; *(c)* head, frontal; *(d)* head, anterolateral.

one or two additional species… from North Queensland (Kuranda)". Hardy (1932) later described the second species in the genus from Australia, *Sargus darius* Hardy, 1932, including a paratype from Kuranda, which is presumably the additional species referred to by Hill.

It is possible that species names applied to the Australian fauna are erroneous, such as *Sargus mactans* Walker, 1859 (originally described from Indonesia), which has been used for specimens from Queensland. In a review of the Oriental Stratiomyidae, Brunetti (1923: 157) identified specimens of *S. mactans* deposited in the BMNH from "North Queensland". This Australian record was adopted by some workers (Hauser & Rozkošný, 1999: 13; Woodley, 2001: 226), however, *S. mactans* was not acknowledged by Hardy (1932) and the name has not been applied to material deposited in most Australian collections. Moreover, it seems unlikely that the southeast Asian fauna have travelled east of the Wallace Line. The identify of *S. mactans* from Australia has been made further complicated by the damaged type specimen from the BMNH (head and left with missing; Fig. 11), in addition to the lack of available key to species and authoritatively identified collection specimens. Therefore, we tentatively retain *S. mactans* as part of the Australian fauna until a much needed species-level revision can be completed for *Sargus* from the Oriental and Australian regions.

Biology. According to James (1960), adults from the Nearctic are commonly found flying near or resting on leaves in sunlight, and visiting flowers such as *Sedum* (stonecrop, Crassulaceae), *Isocoma vernonoides* (goldenbush, Asteraceae), and *Sambucus coetulea* (elderberry, Adoxaceae),

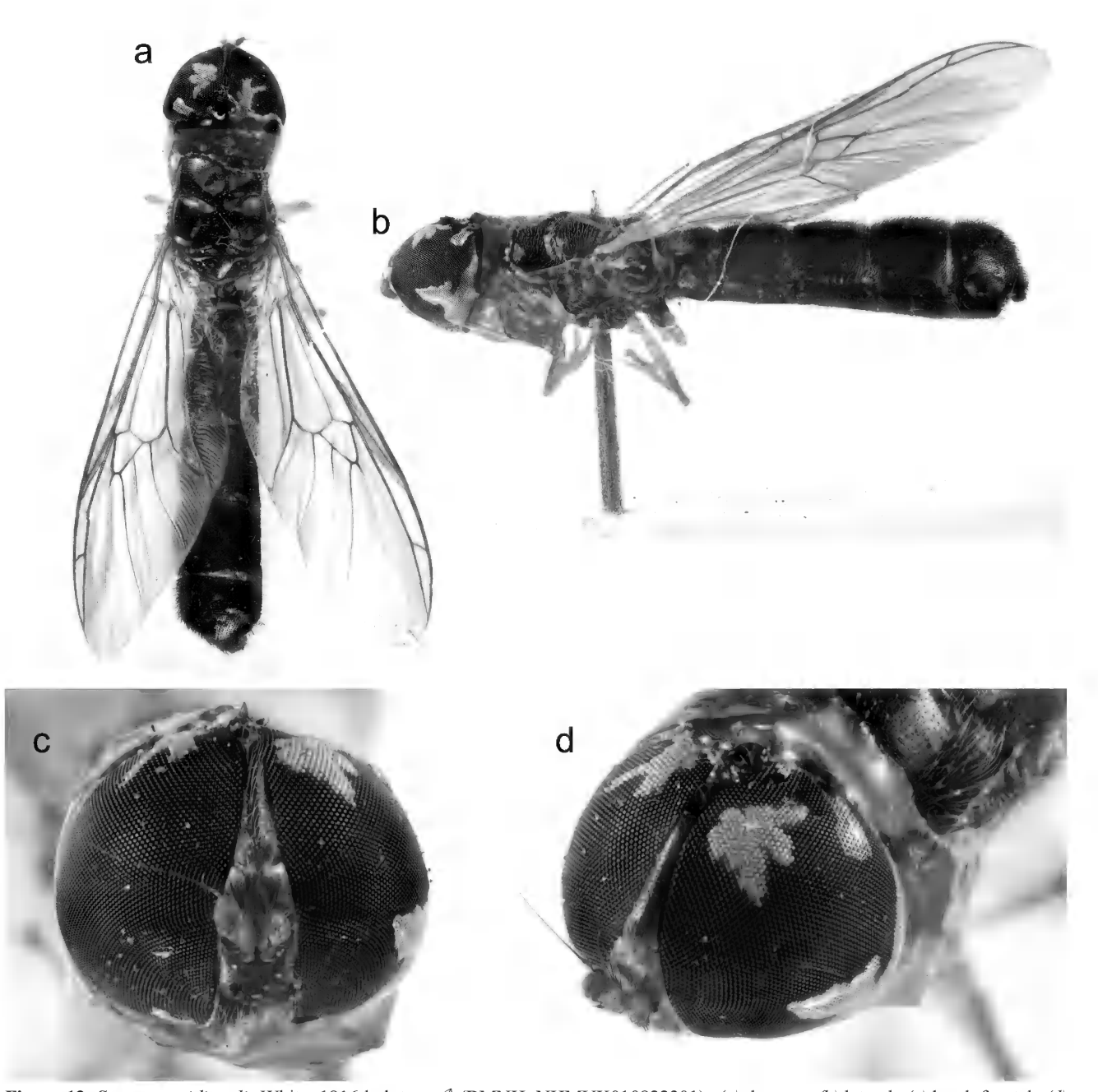

Figure 12. *Sargus meridionalis* White, 1916 holotype ♂ (BMNH: NHMUK010922301): *(a)* dorsum; *(b)* lateral; *(c)* head, frontal; *(d)* head, anterolateral.

whereas the larvae breed in decaying vegetation, including leaves, turnip roots, and/or mammal excrement. Regarding the Australian species, *S. meridionalis* seems to decompose organic waste since it has been bred from human faeces [ANIC 29-037454, 29-037455].

Catalogue of Australian species

Genus *Sargus* Fabricius, 1798

darius Hardy, 1932. Qld.

Sargus darius Hardy, 1932: 47. HT ♀ [location of type unknown]: Qld, Great Palm Island [PT ♀, QM T246603; Fig. 15].

mactans Walker, 1859. Australasian: Australia (Qld), Papua New Guinea (Papua New Guinea). Palaearctic: Japan. Oriental: India, Indonesia (Kalimantan, Sulawesi, Sumatra), Malaysia, Pakistan, Sri Lanka.

Sargus mactans Walker, 1859: 97. HT ♂ (stated ♀) [BMNH; damaged, head and left with missing; Fig. 11]: Indonesia: Sulawesi, Ujung Pandang.

meridionalis White, 1916. NSW.

Sargus meridionalis White, 1916: 95. HT ♂ [BMNH; Figs 12–14]: NSW, Milson Island.

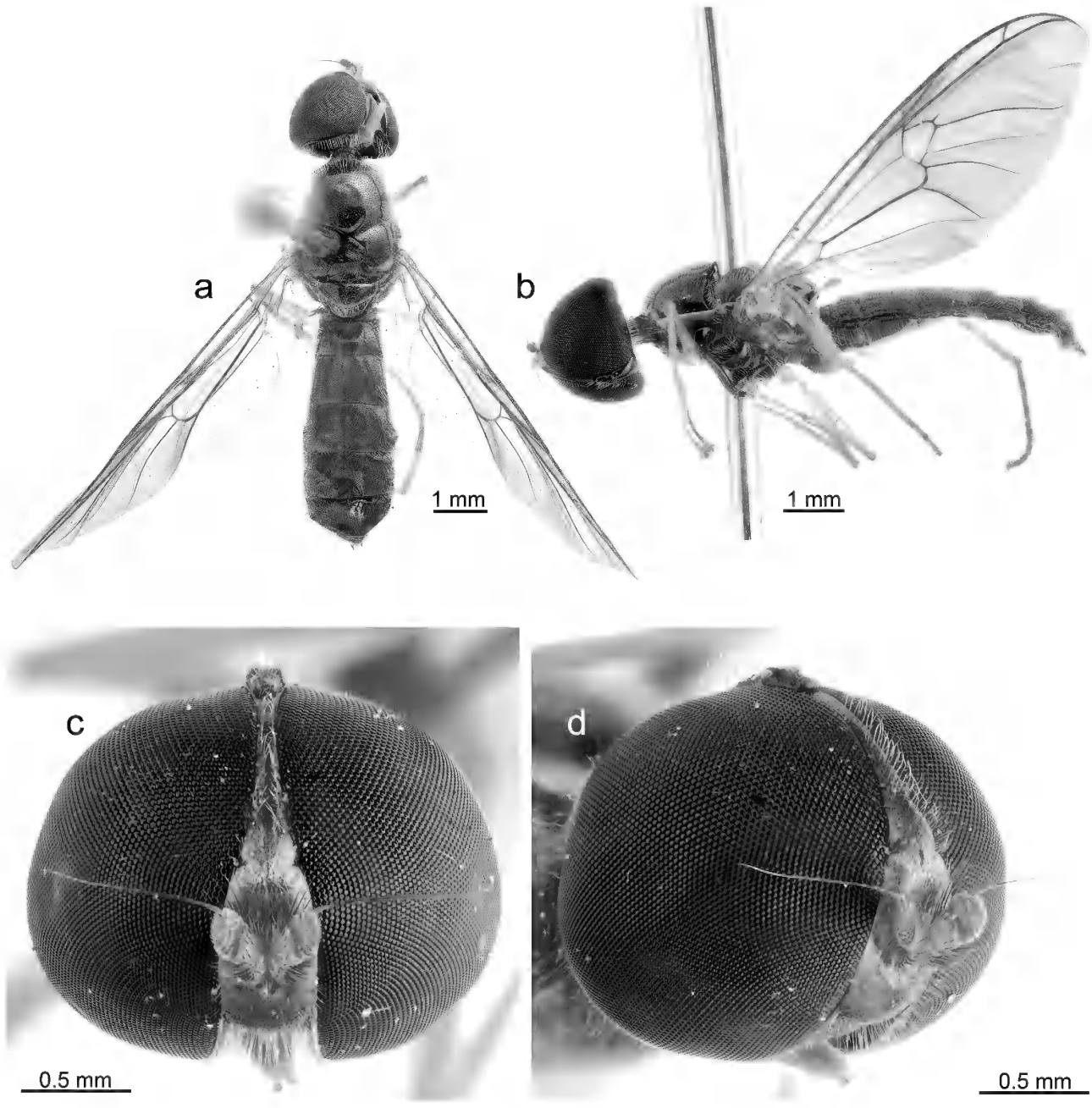

Figure 13. *Sargus meridionalis* White, 1916 non-type ♂ (ANIC 29-037454): *(a)* dorsum; *(b)* lateral; *(c)* head, frontal; *(d)* head, anterolateral.

Acknowledgments. Authors would like to thank: Thekla Pleines (ANIC) for databasing specimens of *Microschysa wrightae*; Xuankun Li (ANIC) for imaging type specimens of *Sargus mactans* and *S. meridionalis* from the BMNH, and assistance with imaging the genitalia; Bronte Sinclair (ANIC) for imaging the paratype of *S. darius*; Thomas Pape and Anders Alexander Illum (UZMC) for imaging the type specimen of *M. flaviventris*; Neal Evenhuis and James Boone (BPBM) for imaging authoritatively identified specimens of *Ptecticus longipes*; Martin Hauser (California Department of Food and Agriculture) for sharing images of the holotype of *Formosargus lineata*; Erica McAlister (BMNH), Russell Cox and Derek Smith (AMS), Christine Lambkin and Susan Wright (Queensland Museum), Justin Bartlett and Desley Tree (Queensland Department of Agriculture and Fisheries), Peter Hudson (SAMA), Ken Walker (National Museum of Victoria), Cathy Byrne and Simon Grove (Tasmanian Museum and Art Gallery) for providing access and/or loaning of material. This paper is a product of the Australian Biological Resources Study (ABRS) National Taxonomy Research Grant Program project "A phylogeny, systematic revision and key to the genera of Australian Soldier Flies (Diptera: Stratiomyidae)" (RF214-30) and the Australian American Fulbright Commission Specialist Grant "Training the next generation of Australian entomologist through research, fieldwork and scientific writing".

References

Bigot, J. M. F. 1879. Diptères nouveaux ou peu connus. 11e partie. XVI. Curiae Xylophagidarum et Stratiomydarum (Bigot). *Annales de la Société Entomologique de France, Cinquième série* 9: 209–234.

Bigot, J. M. F. 1891. Catalogue of the Diptera of the Oriental Region. Part I. *Journal of the Asiatic Society of Bengal, New Series* 60: 250–282.

https://doi.org/10.5962/bhl.title.9296

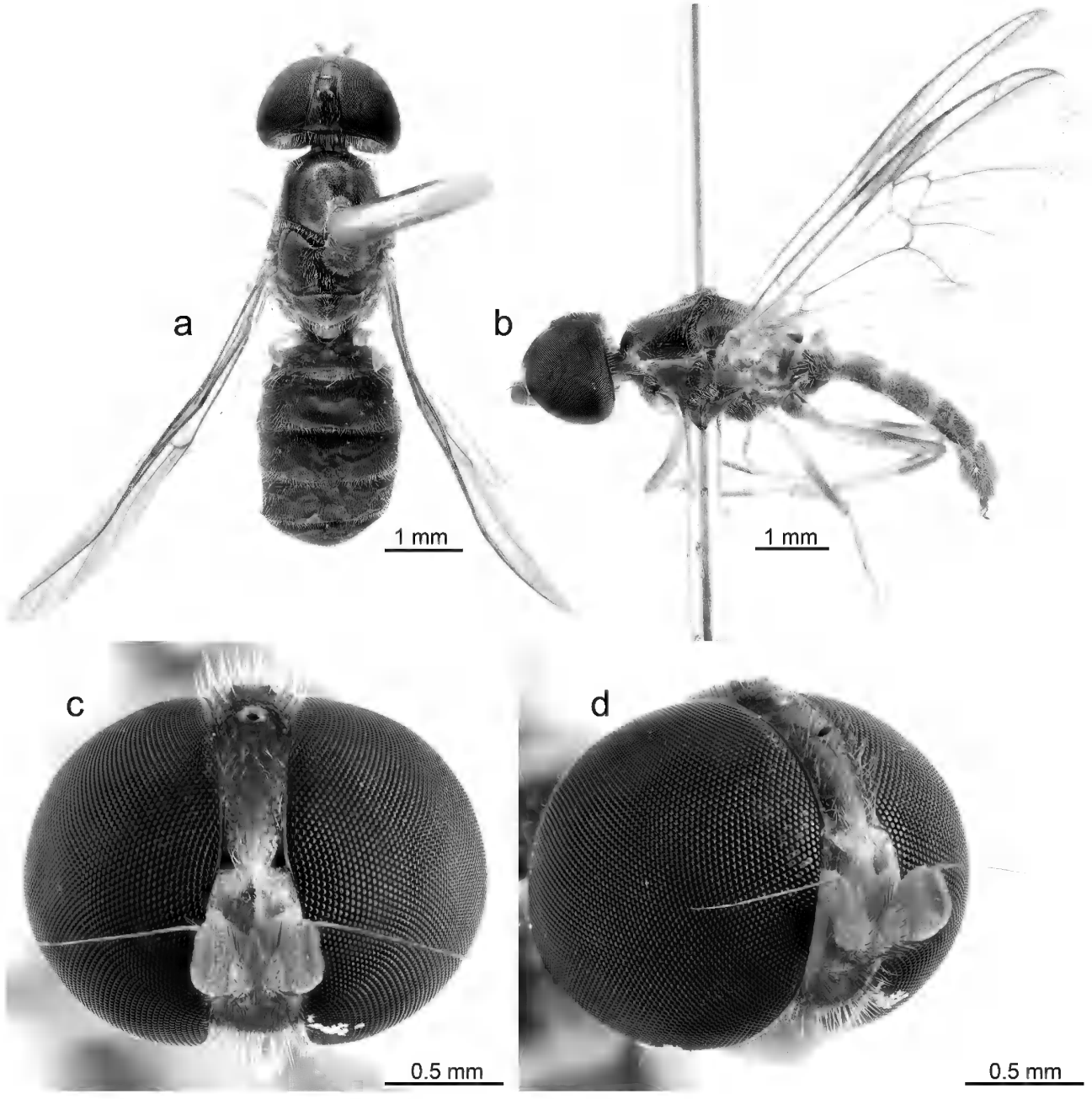

Figure 14. *Sargus meridionalis* White, 1916 non-type ♀ (ANIC 29-037455): *(a)* dorsum; *(b)* lateral; *(c)* head, frontal; *(d)* head, anterolateral.

Brunetti, E. 1923. Second revision of the Oriental Stratiomyidae. *Records of the Indian Museum* 25: 45–180.

Brammer, C. A., and C. D. von Dohlen. 2007. Evolutionary history of Stratiomyidae (Insecta: Diptera): The molecular phylogeny of a diverse family of flies. *Molecular Phylogenetics and Evolution* 43: 660–673.
https://doi.org/10.1016/j.ympev.2006.09.006

Brammer, C. A., and C. D. von Dohlen. 2010. Morphological phylogeny of the variable fly family Stratiomyidae (Insecta, Diptera). *Zoologica Scripta* 39: 363–377.
https://doi.org/10.1111/j.1463-6409.2010.00430.x

Cumming, J. M., and D. M. Wood. 2017. Adult Morphology and Terminology. In *Manual of Afrotropical Diptera. Volume 1. Introductory Chapters and Keys to Diptera Families*, ed. A. H. Kirk-Spriggs and B. J. Sinclair, pp. 89–133. Pretoria: Suricata 4. SANBI Graphics and Editing.

Daniels, G. 1979. The genus *Ptecticus* Loew from Australia, New Guinea and the Bismarck and Solomon Archipelagos (Diptera: Stratiomyidae). *Records of the Australian Museum* 32(18): 563–588.
https://doi.org/10.3853/j.0067-1975.32.1979.466

Fabricius, J. C. 1798. *Supplementum Entomologiae Systematicae*. Proft et Storch, Hafniae [= Copenhagen]. [4], 1–572.
https://doi.org/10.5962/bhl.title.122153

Hardy, G. H. 1918. Notes on Tasmanian Diptera and description of new species. *Papers & Proceedings of the Royal Society of Tasmania* 1917: 60–66.
https://doi.org/10.5962/bhl.part.11374

Hardy, G. H. 1920. Australian Stratiomyiidae. *Papers and Proceedings of the Royal Society of Tasmania* 1920: 33–64.
https://doi.org/10.5962/bhl.part.18312

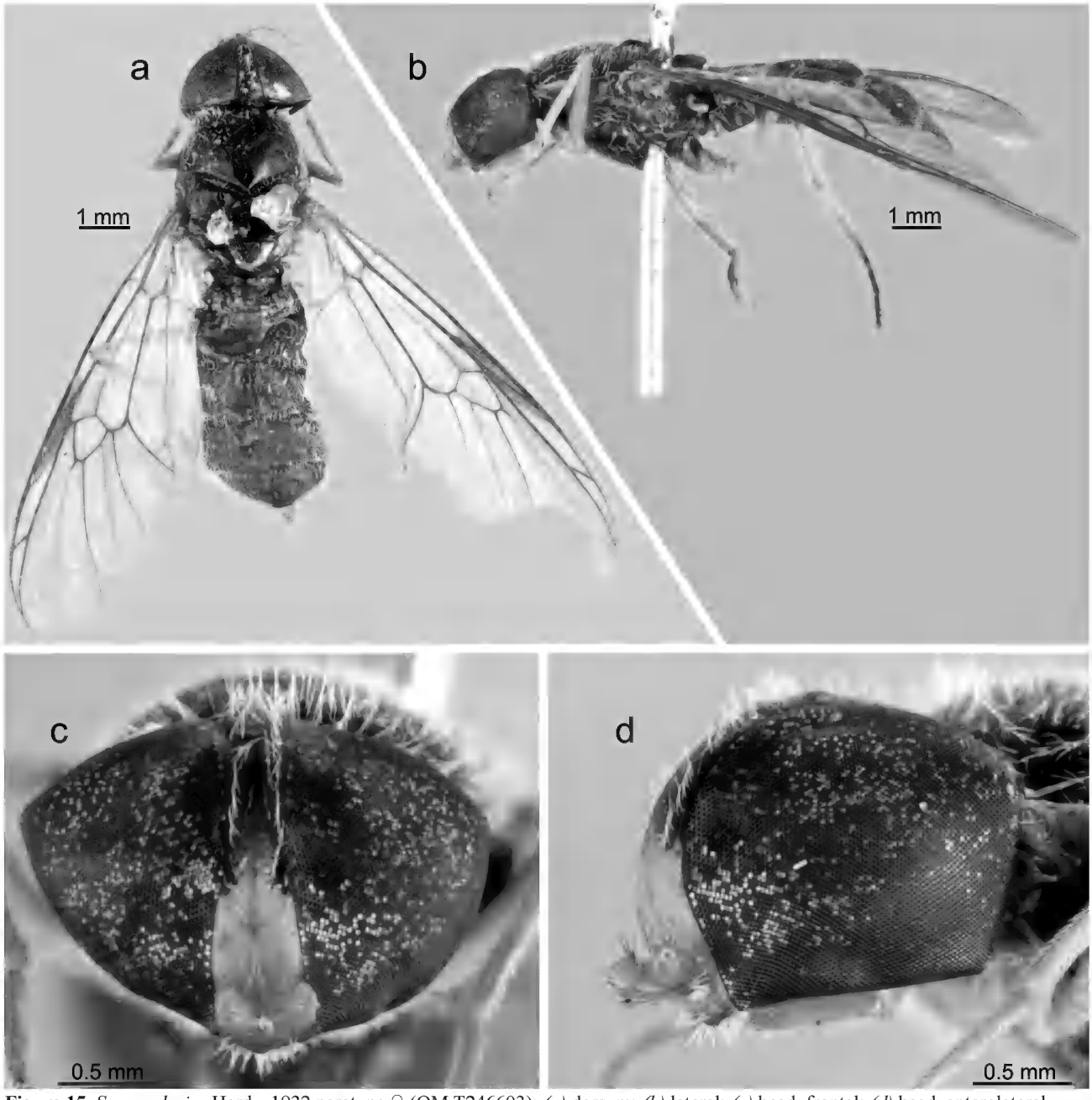

Figure 15. *Sargus darius* Hardy, 1932 paratype ♀ (QM T246603): *(a)* dorsum; *(b)* lateral; *(c)* head, frontal; *(d)* head, anterolateral.

Hardy, G. H. 1932. Notes on Australian Stratiomyiidae. *Proceedings of the Royal Society of Queensland* 44: 41–49.

Hauser, M., and R. Rozkošný. 1999. An annotated list of Stratiomyidae (Diptera) from Sri Lanka with taxonomic notes on some genera. *Stuttgarter Beiträge zur Naturkunde Serie A (Biologie)* 585: 1–15.

Hauser, M., N. E. Woodley, and D. A. Fachin. 2017. Stratiomyidae (Soldier Flies). In *Manual of Afrotropical Diptera. Volume 2. Nematocerous Diptera and lower Brachycera*, ed. A. H. Kirk-Spriggs and B. J. Sinclair, pp. 919–979. Pretoria: Suricata 5. SANBI Graphics and Editing.

Hill, G. F. 1919. Australian Stratiomyidae (Diptera), with description of new species. *Proceedings of the Linnean Society of New South Wales* 44: 450–462.

International Commission on Zoological Nomenclature. 1987. Opinion 1443. *Microchrysa* Loew, 1855 (Insecta, Diptera): conserved. *The Bulletin of Zoological Nomenclature* 44: 148.

James, M. T. 1939. New Formosan Stratiomyidae in the collection of the Deutsches Entomologisches Institut. *Arbeiten über morphologische und taxonomische Entomologie aus Berlin-Dahlem* 6: 31–37.

James, M. T. 1960. The Soldier Flies or Stratiomyidae of California. In *Bulletin of the California Insect Survey Volume 6*, ed. E. G. Linsley, S. B. Freeborn, P. D. Hurd, and R. L. Usinger, pp. 79–122. London: Cambridge University Press.

Kertész, K. 1912. The Percy Sladen Trust Expedition to the Indian Ocean in 1905, under the leadership of Mr J. Stanley Gardiner, M. A. Volume IV. No. VI. Diptera, Stratiomyiidae. The *Transactions of the Linnean Society of London 2nd Series, Zoology* 15: 95–99.
https://doi.org/10.1111/j.1096-3642.1912.tb00091.x

Latreille, P. A. 1810. *Considérations Générales Sur L'ordre Naturel Des Animaux Composant Les Classes Des Crustacés, Des Arachnides, Et Des Insectes; Avec Un Tableau Méthodique De Leurs Genres, Disposés En Familles*. Paris: F. Schoell.
https://doi.org/10.5962/bhl.title.39620

Lessard, B. D., D. K. Yeates, and N. E. Woodley. 2018. Revision of the Hermetiinae of Australia (Diptera: Stratiomyidae). *Austral Entomology* 58: 122–136 (online publication date 16 April 2018).
https://doi.org/10.1111/aen.12333

Lessard, B. D., D. K. Yeates, and N. E. Woodley. 2019. Revision of the Stratiomyinae soldier flies of Australia (Diptera: Stratiomyidae), with one new genus and first records of *Prosopochrysa* de Meijere, 1907. *Insect Systematics & Evolution* (online publication date 28 Apr 2019).
https://doi.org/10.1163/1876312X-00002307

Lessard, B. D., D. K. Yeates, and N. E. Woodley. 2020. Generic revision of the Chiromyzinae soldier flies of Australia (Diptera: Stratiomyidae), including the first record of Boreoides Hardy, 1920 from New Zealand. *Austral Entomology* (online publication date 7 February 2020).
https://doi.org/10.1111/aen.12449

Lindner, E. 1935. Stratiomyiiden von Celebes (Dipt.). (Sammlung Gerd Heinrich.). *Konowia* 14: 42–50.

Loew, H. 1855. Einige Bemerkungen über die Gattung *Sargus*. *Verhandlungen des zoologisch-botanischen Vereins in Wien* 5: 131–148.

Macquart, P. J. M. 1834. *Histoire Naturelle des Insectes*. Diptères. Paris: Librairie Encyclopédique de Roret.
https://doi.org/10.5962/bhl.title.14274

Mason, F., and R. Rozkošný. 2005. Taxonomic and distributional notes on exotic *Ptecticus* and *Sargus* species from some Italian natural history museums (Diptera, Stratiomyidae). In *Doriana: Supplemental Annali del museo civico di storia naturale "G. Doria"*, ed. E. Grafiche, pp. 439–451. Genova: Museo Civico di Scienze Naturali.
https://doi.org/10.11646/zootaxa.1794.1.2

Mason, F., and R. Rozkošný. 2008. A review of the Oriental *Campeprosopa* species (Diptera: Stratiomyidae). *Zootaxa* 1794: 49–64.

Meijere, J. C. H. de. 1913. Dipteren I. Résultats de l'Expédition Scientifique Néerlandaise à la Nouvelle-Guinée. *Nova Guinea* 9: 305–386.

Nagatomi, A. 1975. The Sarginae and Pachygasterinae of Japan (Diptera: Stratiomyidae). *The Transactions of the Royal Entomological Society of London* 126: 305–421.
https://doi.org/10.1111/j.1365-2311.1974.tb00856.x

Rozkošný, R. 1982. *A Biosystematic Study of the European Stratiomyidae (Diptera). Volume 1. Introduction, Beridinae, Sarginae and Stratiomyinae*, ed. K. A. Spencer. Boston: Dr W. Junk Publishers.

Rozkošný, R., and H. de Jong. 2003. Taxonomic and distributional notes on the little known Australasian species of *Ptecticus* Loew (Diptera, Stratiomyidae). *Tijdschrift Voor Entomologie* 146: 241–258.
https://doi.org/10.1163/22119434-900000125

Walker, F. 1858. Catalogue of the dipterous insects collected in the Aru Islands by Mr. A. R. Wallace, with descriptions of new species [part]. *Journal of the Proceedings of the Linnean Society* 3: 77–110.
https://doi.org/10.1111/j.1096-3642.1858.tb02413.x

Walker, F. 1859. Catalogue of the dipterous insects collected at Makessar in Celebes, by Mr. A. R. Wallace, with descriptions of new species [part]. *Journal of the Proceedings of the Linnean Society* 4: 90–96.
https://doi.org/10.1111/j.1096-3642.1859.tb00089.x

Walker, F. 1860. Catalogue of the dipterous insects collected in Amboyna by Mr. A. R. Wallace, with descriptions of new species. *Journal of the Proceedings of the Linnean Society (Supplement)* 5: 144–168.
https://doi.org/10.1111/j.1096-3642.1860.tb01023.x

Walker, F. 1861a. Catalogue of the dipterous insects collected at Dorey, New Guinea, by Mr. A. R. Wallace, with descriptions of new species. *Journal of the Proceedings of the Linnean Society* 5: 229–254.
https://doi.org/10.1111/j.1096-3642.1861.tb02102.x

Walker, F. 1861b. Catalogue of the dipterous insects collected in Batchian, Kaisaa and Makian, and at Tidon in Celebes, by Mr. A. R. Wallace, with descriptions of new species. *Journal of the Proceedings of the Linnean Society* 5: 270–303.
https://doi.org/10.1111/j.1096-3642.1861.tb02237.x

Westwood, J. O. 1840. *Synopsis of the Genera of British Insects*. In *An Introduction to the Modern Classification of Insects; Founded On the Natural Habits and Corresponding Organisation of the Different Families. Vol. II*, ed. J. O. Westwood, pp. 97–158. London: Longman, Orme, Brown, Green, and Longmans.
https://doi.org/10.5962/bhl.title.12455

White, A. 1916. A revision of the Stratiomyidae of Australia. *Proceedings of the Linnean Society of New South Wales* 41: 71–100.
https://doi.org/10.5962/bhl.part.15307

Woodley, N. E. 2001. A World Catalog of Stratiomyidae (Insecta: Diptera). *Myia* 11: 1–475.

Woodley, N. E. 2009. *Microschysa flaviventris* (Wiedemann), a new immigrant soldier fly in the United States (Diptera: Stratiomyidae). *Proceedings of the Entomological Society of Washington* 111: 527–529.
https://doi.org/10.4289/0013-8797-111.2.527

Wulp, F. M. van der. 1869. Diptera uit den Oost-Indischen Archipel. *Tijdschrift voor Entomologie* 11: 97–119.

Wulp, F. M. van der. 1896. *Catalogue of the described Diptera from South Asia*. The Hague: The Dutch Entomological Society.
https://doi.org/10.5962/bhl.title.8539

Wulp, F. M. van der. 1898. Dipteren aus Neu-Guinea in der Sammlung des Ungarischen National-Museums. *Természetrajzi Füzetek* 21: 409–426.

Records of the Australian Museum (2020)
vol. 72, issue no. 2, pp. 45–62
https://doi.org/10.3853/j.2201-4349.72.2020.1764

Records of the Australian Museum
a peer-reviewed open-access journal
published by the Australian Museum, Sydney
communicating knowledge derived from our collections
ISSN 0067-1975 (print), 2201-4349 (online)

A New Genus and Two New Species of Caprellidae (Crustacea: Amphipoda) from Mesophotic and Deep-sea Waters of Australia

José M. Guerra-García[1] and Shane T. Ahyong[2]

[1] Laboratorio de Biología Marina, Departamento de Zoología, Facultad de Biología, Universidad de Sevilla, Avda Reina Mercedes 6, 41012, Seville, Spain

[2] Australian Museum Research Institute, Australian Museum, 1 William Street, Sydney NSW 2010, Australia, and

[2] School of Biological, Earth & Environmental Sciences, University of New South Wales, Kensington NSW 2052, Australia

Abstract. Caprellids from mesophotic and deep-sea waters from Australia have been scarcely studied. A new genus *Pseudoliropus* gen. nov., and two new species *Pseudoliropus keablei* and *Pseudoprotella australiensis* sp. nov. are described based on material collected from 56 to 1125 m deep during surveys on board the vessels RV *Sprightly* (1973), FRV *Kapala* (1977–1986) and RV *Southern Surveyor* (2005) along the coast of the Northern Territory, Queensland, New South Wales, Victoria and Tasmania. *Pseudoliropus* is superficially very close to *Liropus* but can be readily distinguished by the absence of a mandibular molar (present in *Liropus*) and 2-articulate mandibular palp (3-articulate in *Liropus*). *Pseudoprotella australiensis* can be differentiated from all the remaining species of *Pseudoprotella* mainly on the basis of the unique body ornamentation (acute projection on the head, pereonites with abundant tiny tubercles scattered over the surface, and rows of lateral tubercles on the proximal end of pereonites 2–4). Further collections in deep ecosystems are mandatory to properly understand global amphipod diversity in Australian waters.

Introduction

The least known ocean regions occur below depths accessible to SCUBA diving and include mesophotic ecosystems and the deep sea (Woodall *et al.*, 2018).

The past several decades have seen interest in characterizing the biodiversity and ecology of mesophotic ecosystems, and in particular, mesophotic coral ecosystems (MCEs) (Bell *et al.*, 2018). These are communities of corals, sponges, algae, associated invertebrates and fishes that occur in the transition zone between well-lit surface waters and dark deeper waters, usually from 30–40 to 150 m deep (Abesamis *et al.*, 2018). The lower limit of the mesophotic corresponds to the maximum depth at which there is sunlight penetration to support photosynthesis and, hence, the growth of zooxanthellate coral reefs (Hinderstein *et al.*, 2010). Some coral biologists divide the mesophotic into upper and lower portions, with a faunal transition of species around 60 m (see Baldwin *et al.*, 2018 and references therein). Unlike isolated lower mesophotic reefs (60–150 m), which contain many endemic species, upper mesophotic reefs (30–60 m) are inhabited by numerous shallow reef organisms threatened by local and global stressors, which find refugia in MCEs (Weinstein *et al.*, 2014). The increasing availability of remotely operated vehicles (ROV) and autonomous underwater vehicles (AUV) (e.g., Englebert *et al.*, 2017;

Keywords: mesophotic; deep-sea; Amphipoda; Caprellidae; new taxa; Australia
Zoobank registration: urn:lsid:zoobank.org:pub:D7F01FA2-5EBE-4C9C-B2E1-761AEC982532
Corresponding author: José M. Guerra-García jmguerra@us.es
Received: 7 April 2020 **Accepted**: 22 May 2020 **Published**: 24 June 2020 (in print and online simultaneously)
Publisher: The Australian Museum, Sydney, Australia (a statutory authority of, and principally funded by, the NSW State Government)
Citation: Guerra-García, José M., and Shane T. Ahyong. 2020. A new genus and two new species of Caprellidae (Crustacea: Amphipoda) from mesophotic and deep-sea waters of Australia. *Records of the Australian Museum* 72(2): 45–62. https://doi.org/10.3853/j.2201-4349.72.2020.1764

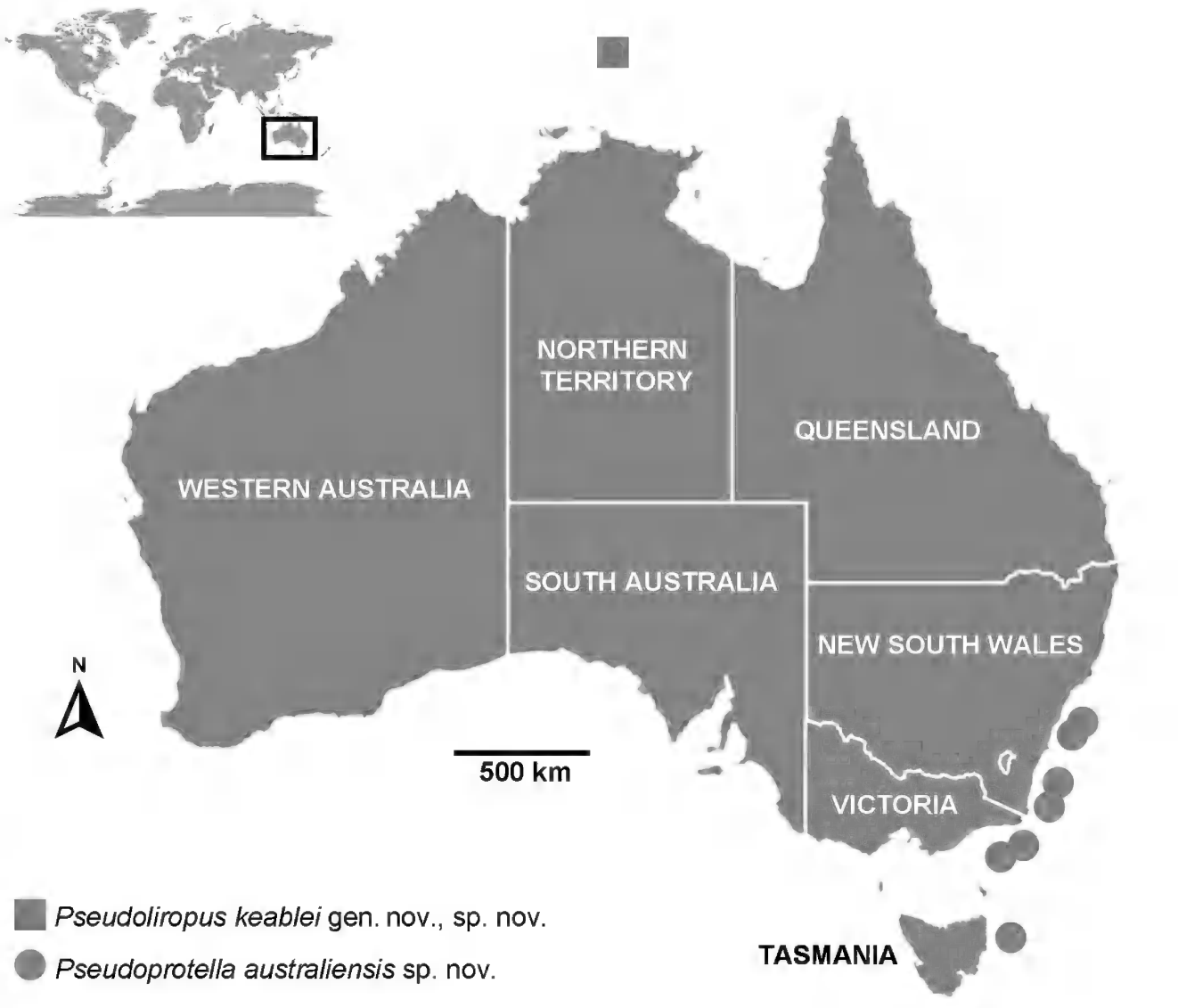

Figure 1. Localities at which the new genus and the new species were found.

Turner *et al.*, 2018), together with new diving technologies that combine Tri-Mix Diving and Rebreathers (e.g., Guerra-García *et al.*, 2015) are contributing to a better knowledge of these ecosystems complementing the traditional use of grabs or trawls. Despite this, however, there are still some highly diverse geographic areas where mesophotic ecosystems have yet to be explored and characterized (Bell *et al.*, 2018) and taxonomical and ecological studies are still lacking in the equatorial Indo-West Pacific region where the most species-rich coral reefs in the world are highly threatened by human activities and climate change (see Abesamis *et al.*, 2018 and references therein). Further, most published studies focus on sessile flora and fauna, but the small epibiont, vagile organisms are often overlooked. Indeed, sporadic sampling in mesophotic ecosystems often reveal the presence of novel genera and species of associated macrofauna, such as small peracarids (e.g., Petrescu *et al.*, 2012; Senna *et al.*, 2014).

The deep sea is considered to start at about 200 meters depth, at the shelf break, where a clear change of fauna from shallow to deep water is observed (Thistle, 2003). The waters deeper than 200 m form the largest environment on Earth with a volume of 1368 x10^6 km^3 covering an area of 360 million km^2, equivalent to about 50% of the surface of the Earth with an average depth of 3,800 m and a maximum depth of 10,924 m in the Mariana Trench (Ramirez-Llodra *et al.*, 2011). Nevertheless, as with mesophotic ecosystems, most deep-sea habitats still remain unexplored. For example, deep-sea surveys that include amphipods usually reveal that most of the caprellids collected are new to science (see e.g., Laubitz, 1972; Laubitz & Mills, 1972; Guerra-García, 2003, 2004; Takeuchi *et al.*, 2016; Zettler *et al.*, 2018).

In Australian waters, there is an increasing interest in characterizing mesophotic communities (see e.g., Turner *et al.*, 2018. in Ningaloo Marine Park, Western Australia) and the fauna of deep-sea ecosystems (e.g., Horowitz *et al.*, 2018; Tanner *et al.*, 2018; Williams *et al.*, 2018; MacIntosh *et al.*, 2018; Farrelly & Ahyong, 2019). However, most studies are mainly focused on larger and most conspicuous organisms and there is a lack of knowledge dealing with the taxonomy of small epibiont organisms (e.g., Lowry & Stoddart, 2010). The present study deals with the description of new amphipod taxa found during sampling surveys focused on mesophotic ecosystems and deep sea of Australia (Fig. 1). A new genus and two new species of Caprellidae are fully described and illustrated.

Material and methods

Caprellids were collected by RV *Sprightly* in 1973, FRV *Kapala* in 1977–1986 and RV *Southern Surveyor* in May 2005 (see Wilson, 2005, for details). Specimens of the new species were dissected in 80% ethanol and slides were made using Aquatex® mounting medium (Merck Millipore Ltd). Figure plates were made following Takeuchi (2015) and Guerra-García *et al*. (2020). Firstly, original sketches of lateral view, antennae, gnathopods, pereopods and mouthparts were drawn using a Leica compound microscope equipped with a camera lucida. Figures were inked using Rotring pens based on the reduced copies of the original sketches organized in plates. Finally, with Photoshop 6, drawings were improved, cleaned and final plates arranged. Body length was measured from the anterior end of the head to the posterior end of pereonite 7. The symbols used in the present work are: *A1, 2* = Antenna 1, 2; *UL* = Upper lip; *LL* = Lower lip; *LMd* = Left mandible; *RMd* = Right mandible; *Mx 1, 2* = Maxilla 1, 2; *Mxp* = Maxilliped; *Gn 1, 2* = Gnathopod 1, 2; *P5–7* = Pereopod 5–7; *Ab* = Abdomen. In the descriptions, the term "spine" is used for stout, inflexible articulated structures, "seta" for slender, flexible articulated structures and "setule" for very short setae. Systematic classification was based on Lowry & Myers (2013, 2017). Specimens of the new genus and species are deposited in the Australian Museum (AM).

Taxonomic account

Superfamily Caprelloidea Leach, 1814

Family Caprellidae Leach, 1814

Subfamily Caprellinae Leach, 1814

Pseudoliropus gen. nov.

http://zoobank.org/NomenclaturalActs/904A1ABE-2698-40DE-A5B4-CC26549DF905

Diagnosis. Antenna 1 flagellum with more than 2 articles. Antenna 2 flagellum 2-articulate, swimming setae absent. Pereonites 3 and 4 with gills. Pereopods 3 and 4 uni-articulate. Pereopod 5 3-articulate. Pereopods 6 and 7 6-articulate. Mandible molar absent; mandible palp 2-articulate. Abdomen without appendages.

Type species. *Pseudoliropus keablei* sp. nov.

Etymology. The new genus superficially resembles the genus *Liropus*. The name is, therefore, composed of *Pseudo-* (=not genuine) and *Liropus*. Gender: masculine.

Pseudoliropus keablei sp. nov.

http://zoobank.org/NomenclaturalActs/B6A4E2C2-C597-413E-A0B6-19DF72908CB6

Figs 2–5

Holotype: AM P.79076, mature male (vial + 3 slides) (mouthparts dissected, used for description, figured), Arafura Sea, Area C South, Northern Territory, Australia, 9°10'32"S 133°29'40"E, 136 m depth, RV *Southern Surveyor*, "Southern Surveyor Arafura Sea Cruise May 2005", Smith-McIntyre Grab, calcareous muddy gravel with mostly shell fragments coral, fixed in 5% formalin, preserved 80% ethanol, coll. G.D.F. Wilson, 21 May 2005. **Paratypes** (collected together with holotype): AM P.101357, *paratype "a"*, mature female (vial + 1 slide) (mouthparts dissected, used for description, figured); AM P.101358, 2 premature females (not dissected).

Etymology. This species is dedicated to our friend and colleague Dr Stephen Keable. JMGG is very grateful to him for his continuous support, help and friendship during visits to the Australian Museum.

Diagnosis. Eyes present, although with few ommatidia. Body of male covered by abundant tiny dorsal tubercles from pereonite 2–5 and basis of gnathopod 2; pereonite 2 with small acute anterolateral projections; pereonites 3 and 4 with small, serrate, anterolateral projections. Body of female smooth. Maxilliped palp article 3 without distal projection. Mandibular molar absent; palp with 2 apical setae. Gnathopod 2 basis shorter than pereonite 2. Pereopods 3 and 4 1-articulate. Pereopod 5 3-articulate. Abdomen without appendages.

Description. *Holotype male* AM P.79076 (3.3 mm)

Lateral view (Fig. 2). Body dorsally covered by tiny dorsal tubercles on pereonites 2–5 and basis of gnathopod 2. Eyes with few ommatidia. Pereonite 1 fused with head, suture present. Small, acute anterolateral projections on pereonite 2 and small serrate anterolateral projections on pereonites 3–4. Pereonite 5 longest. Pereonite 7 shortest.

Gills (Fig. 2). Present at middle of pereonites 3–4, small, oval, length about 1.5 × width.

Mouthparts (Fig. 3). (Maxilliped and mandibles figured and described from holotype male; maxilla 1 and 2, upper and lower lips figured and described from paratype "a" female). Mouthparts remarkably small (ca. 0.05 mm; 0.015 × body length). Mandibular molar absent; palp 2-articulate, distal article the longest, with 2 apical setae; left mandible with incisor and lacinia mobilis 5-dentate, accessory blades not clearly distinguished; incisor of right mandible 5-dentate, lacinia mobilis blade-like, followed by 2 more blades; no trace of molar flake. Upper lip without setae. Lower lip without setae, inner lobes apparently fused. Maxilla 1 outer lobe with 5 spines; palp 2-articulate, distal article with 3 apical spines and medial seta. Maxilla 2 inner and outer lobe of similar size, small, each with 3 distal setae. Maxilliped inner plate small, length about 1/4 outer plate length, with 2 apical setae; outer plate elongate, with 4 or 5 setae; palp 4-articulate, article 2 with distal seta, article 3 with 2 apical setae, article 4 with few setulae.

Antennae (Figs 2, 4). Antenna 1 ca. 1/5 body length; flagellum 4-articulate. Antenna 2 about 1/2 length of antenna 1; proximal peduncular article with acute gland cone distally; swimming setae absent; flagellum 2-articulate.

Gnathopods (Figs 2, 4). Gnathopod 1 basis as long as ischium, merus and carpus combined; occlusal margin of propodus smooth, with row of fine setulae; 2 proximal grasping spines, dactylus bifid distally and with row of setulae. Gnathopod 2 inserted on anterior half of pereonite 2; coxa with distal projection (see detail in Fig. 2); basis about 2/3 length of pereonite 2, with tiny tubercles similar to

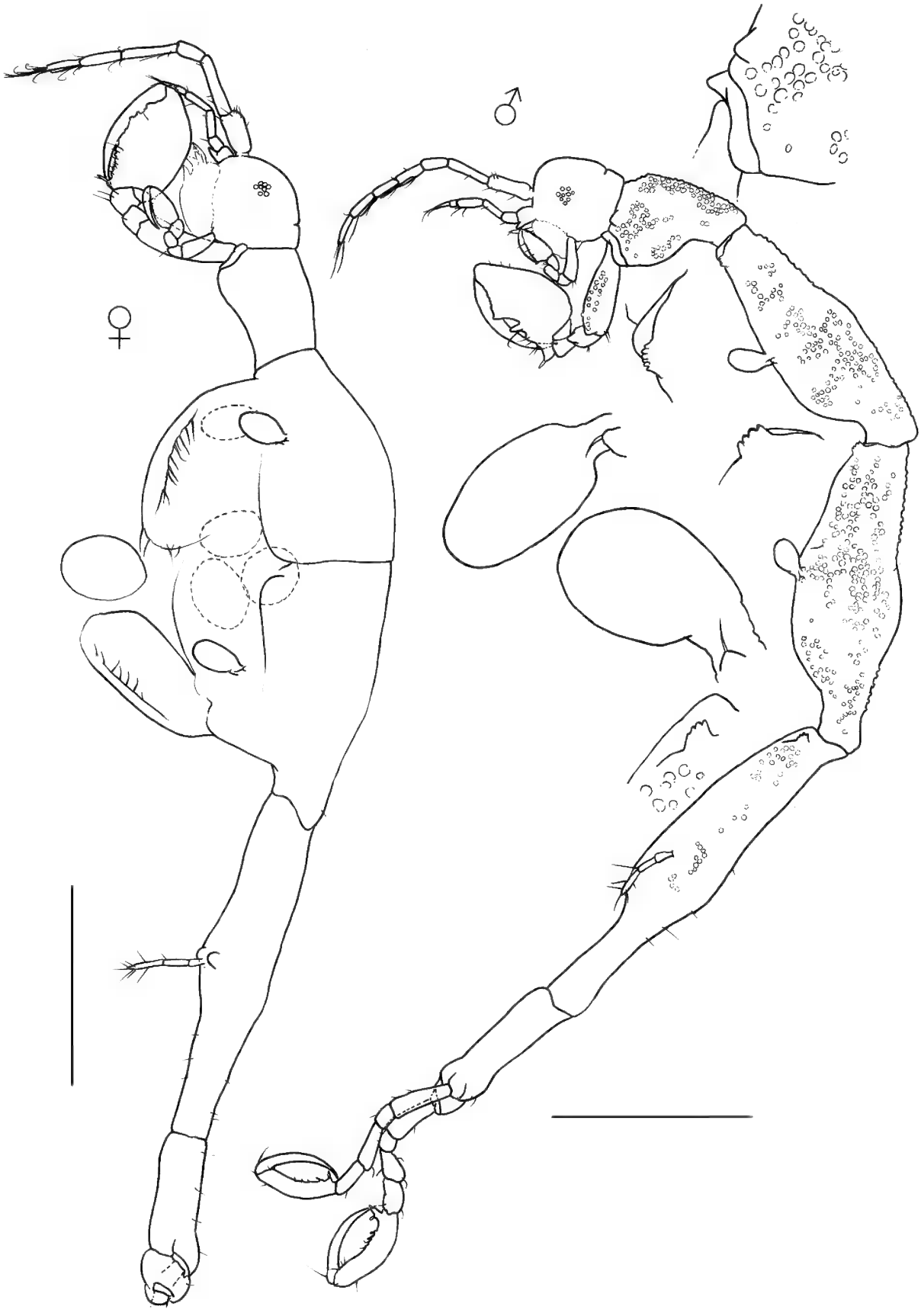

Figure 2. *Pseudoliropus keablei* sp. nov. Lateral view of holotype male AM P.79076 and paratype "a" female AM P.101357. Scale bars: 0.5 mm.

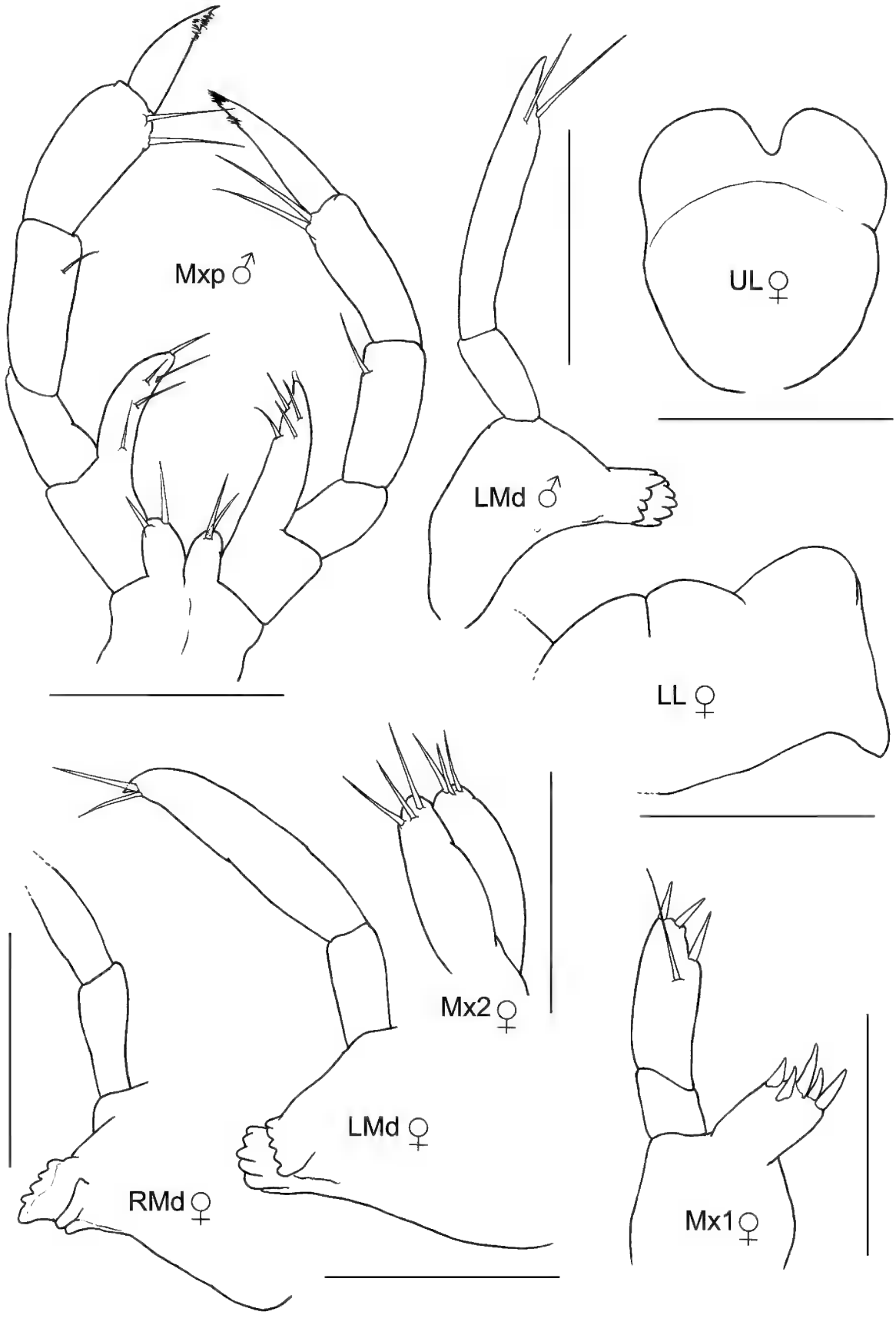

Figure 3. *Pseudoliropus keablei* sp. nov. Mouthparts. Maxilliped and left mandible of holotype male AM P.79076; maxilla 1, maxilla 2, upper lip, lower lip and mandibles of paratype "a" female AM P.101357. Scale bars: 0.05 mm.

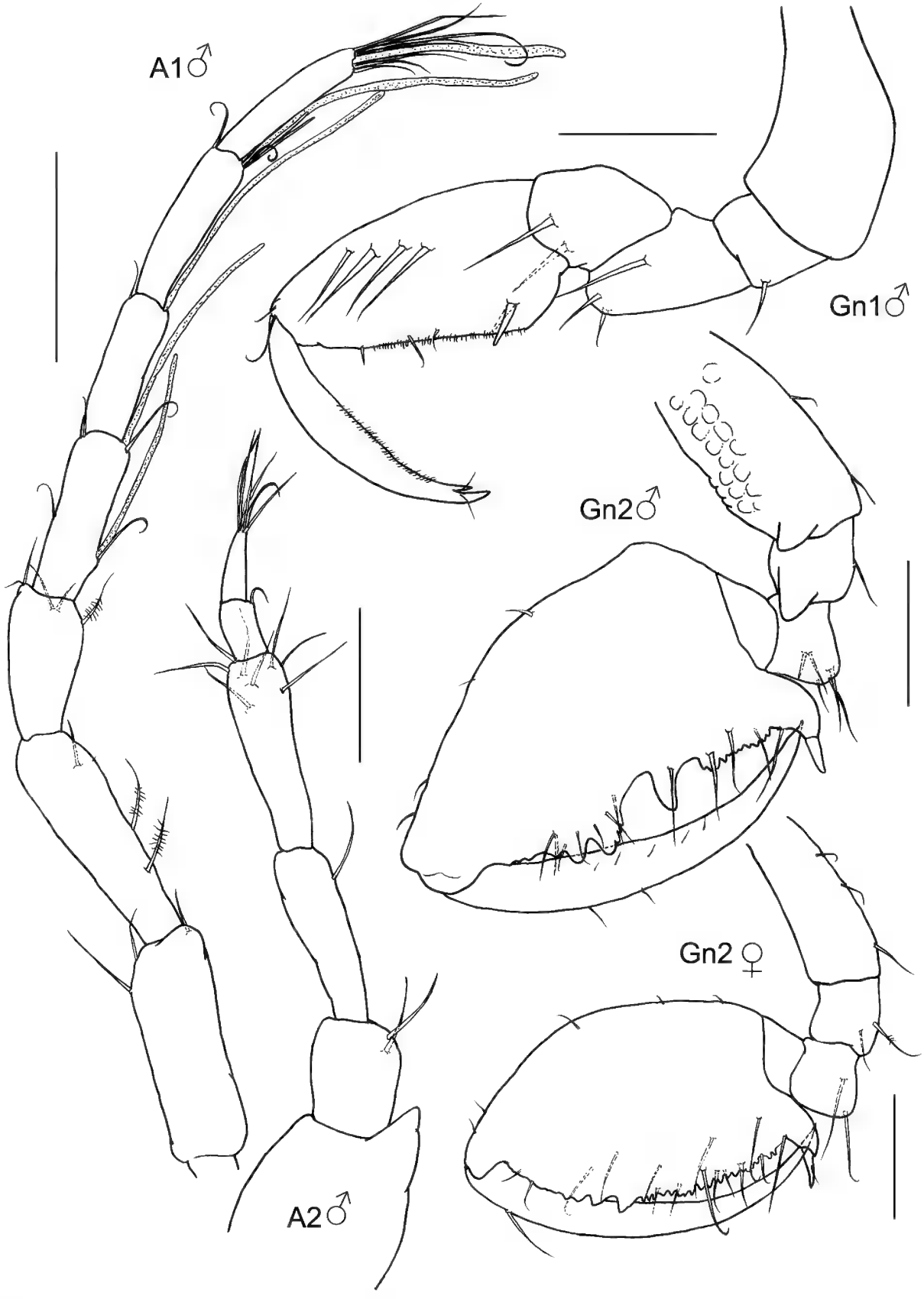

Figure 4. *Pseudoliropus keablei* sp. nov. Antenna 1, antenna 2, gnathopod 1 and gnathopod 2 of holotype male AM P.79076; gnathopod 2 of paratype "a" female AM P.101357. Scale bars: 0.1 mm (A1, Gn2), 0.05 (A2, Gn1).

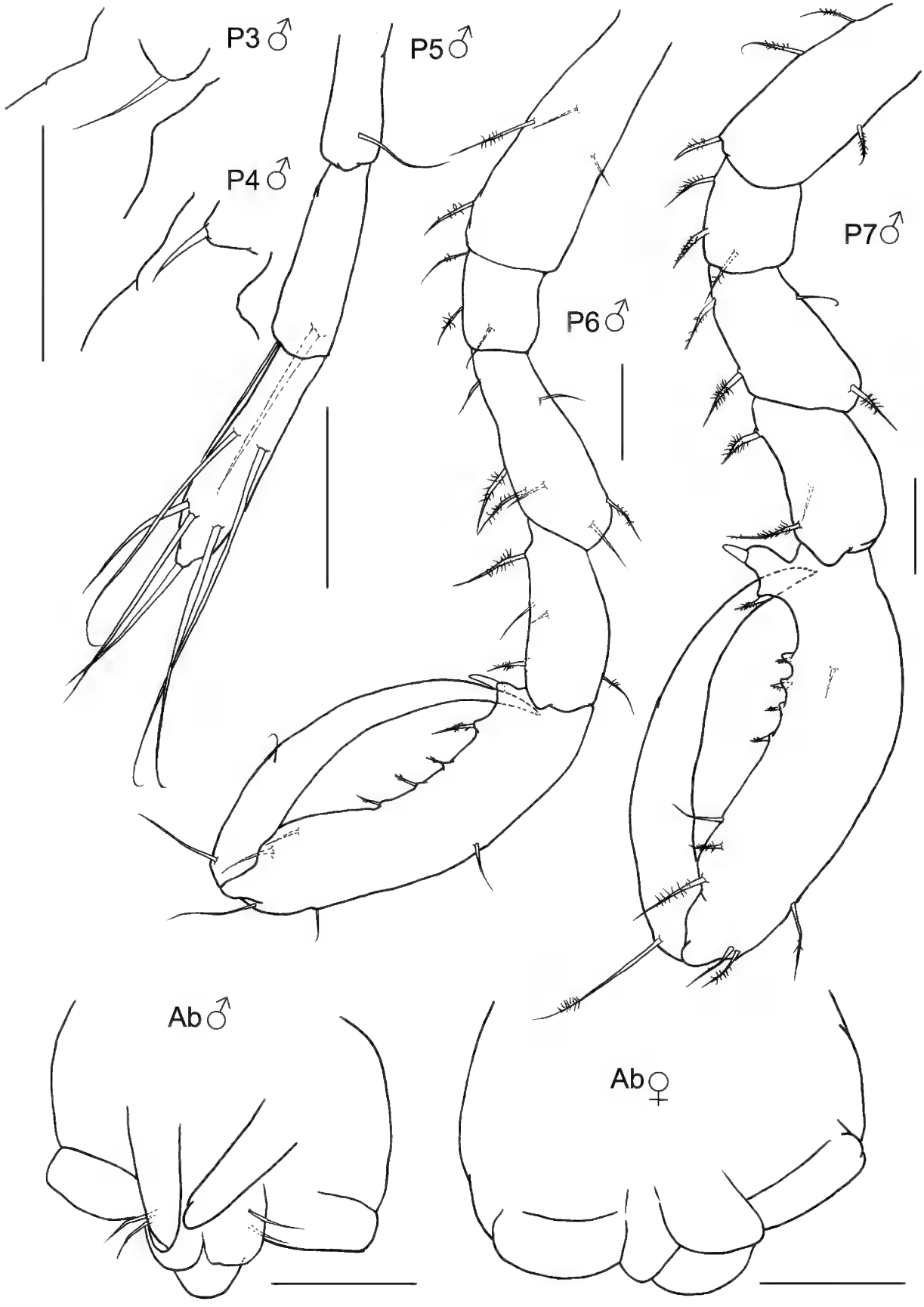

Figure 5. *Pseudoliropus keablei* sp. nov. Pereopods 3, 4, 5, 6 and 7 and abdomen of holotype male; abdomen of paratype "a" female AM P.101357. Scale bars: 0.05 mm.

those on pereonites; ischium rectangular; basis and ischium with distal projection laterally; merus rounded; carpus short, triangular; propodus palm with proximal projection with large grasping spine, serrated area, medial projection, and 2 more projections distally (Fig. 4); dactylus smooth and elongate, with very fine setulae only.

Pereopods (Figs 2, 5). Pereopods 3 and 4 tiny (ca. 0.01 mm, 0.003 × body length), 1-articulate, with distal seta. Pereopod 5 3-articulate, inserted at middle of pereonite 5, proximal and medial article with seta, distal article with 5 lateral setae and distal seta. Pereopods 6 and 7 6-articulate, with plumose setae; propodus of pereopod 6 proximal projection with proximal grasping spine; proximal projection of propodus of pereopod 7 larger, with grasping spine and plumose setae; dactylus curved.

Penes (Fig. 5) large, situated laterally, distinctive, elongate, length ca. 3× width.

Abdomen (Fig. 5) lacking appendages; pair of lobes with 2 setae, and single dorsal lobe.

Paratype female "a" AM P.101357 (3.1 mm) (Figs 2–5). Similar to male except as follows: body smooth, lacking tiny tubercles or anterolateral projections; pereonites 3 and 4 with oostegites; antenna 1 flagellum 3-articulate; gnathopod 2 basis without tiny tubercles, basis and ischium lacking distal projection, palm of propodus with proximal projection provided with grasping spine and margin serrated ventrally, medial projection absent. Abdomen lacking setae.

Remarks. The genus *Liropus* was established by Mayer (1890) and currently includes 14 species (Guerra-García *et al*., 2018). A morphological comparison among species of *Liropus* species is provided by Guerra-García & Hendrycks (2013), Mauro & Serejo (2015) and Sánchez-Moyano *et al*. (2015), and an illustrated key to the species was given by Guerra-García & Hendrycks (2013). The new genus *Pseudoliropus* is superficially very close to most species of *Liropus*, sharing short antennae, pereonite 5 elongate in males, and reduced pereopods 3–5. The two genera differ primarily in the mouthparts: (i) mandibular molar is present in *Liropus* but absent in *Pseudoliropus*; and (ii) the mandibular palp is 3-articulate in *Liropus* but 2-articulate in *Pseudoliropus*.

The specimens of *Pseudoliropus keablei* gen. nov, sp. nov. were collected from the Arafura Sea. The Arafura Sea is a continental shelf basin between northern Australia and Indonesian land masses, overlying part of the Sahul Shelf that straddles the Indian Ocean-Australian continental plates (Wilson, 2005). Area C South, the zone from which the specimens were collected, is on the southern flank of Pillar Bank, with depths ranging from 136–182 m. The shallower stations were higher on the bank and consisted of coarser sediments with several grab and rock dredge samples that collected oyster shells, coral and bryozoan fragments. The deeper sites consisted of soft bioturbated sediments with few epifauna (Wilson, 2005). The water temperatures were 14–16°C in the deeper regions of Area C (depth 230 m). Although these temperatures are not typical deep-sea temperatures (typically below 8°C), some deep-water faunal elements, such as stalked crinoids, hexactinellid sponges and deep-water pedunculate barnacles were observed (see Wilson, 2005 for details).

Pseudoprotella Mayer, 1890

Pseudoprotella australiensis sp. nov.

http://zoobank.org/NomenclaturalActs/439B99F5-7E80-4219-9104-AE62535658D6

Figs 6–12

Holotype: AM P.101359, mature male (vial + 2 slides) (mouthparts dissected, used for description, figured), south-east of Broken Bay, New South Wales, Australia, 33°36'S 151°30'E to 33°37'S 151°29'E, 71–75 m, FRV *Kapala*, beam trawl, fixed in formalin, preserved in 80% ethanol, 10 February 1986. **Paratypes**: (same collection data as the holotype): AM P.101360, *paratype "a"*, mature female (vial + 2 slides) (mouthparts dissected, used for description, figured); AM P.101361, *paratype "b"*, mature female (vial, no slides) (mouthparts not dissected); AM P.101362, *paratype "c"*, mature female (vial + 2 slides) (mouthparts dissected); AM P.101363, *paratype "d"* , mature male (vial, no slides) (mouthparts not dissected); AM P.101364, *paratype "e"*, juvenile male (vial, no slides) (mouthparts not dissected, figured); AM P.101365, *paratype "f"*, premature female (vial, no slides) (mouthparts not dissected, figured); AM P.101366, 25 mature males, 11 mature females, 3 premature females (vial containing all these specimens, no slides).

Other material examined. New South Wales, Australia: AM P.101367, 1 mature male, east of Long Reef Point, 33°46'S 151°43'E, 176 m, FRV *Kapala*, dredge, 5 December 1977; AM P.101368, 1 mature female, south-east of Broken Bay, 33°41'S 152°01'E, 1125 m, FRV *Kapala*, 11 December 1978; AM P.101369, 1 mature male, east of Long Reef, 33°46'S 151°48'E, 403 m, FRV *Kapala*, 3 December 1979; AM P.101370, 2 mature males, 2 mature females, 2 juveniles, east of Port Jackson, 33°52'S 151°23'E, 80 m, FRV *Kapala*, epibenthic sled, coll. R.T. Springthorpe, 11 December 1980; AM P.101371, 1 mature male, 1 mature female, east of Port Jackson, 33°50'S 151°32'E to 33°50'S 151°34'E, 132–135 m, FRV *Kapala*, trawl, 18 December 1985; AM P.101372, 3 mature females, east of Long Reef, 33°44'S 151°53'E to 33°43'S 151°54'E, 494–518 m, FRV *Kapala*, trawl, 18 December 1985; AM P.101373, 2 mature females, east of Long Reef, 33°43'S 151°46'E to 33°44'S 151°46'E, 174 m, FRV *Kapala*, epibenthic sled, coll. J. K. Lowry, R. T. Springthorpe, 20 December 1985; AM P.101374, 3 mature males, 1 premature female, 1 mature female, east of Barrenjoey Headland, 33°36'S 151°26'E to 33°36'S 151°27'E, 56 m, FRV *Kapala*, trawl, 10 February 1986; AM P.101378, 1 mature male, south-east of Disaster Bay, 37°23'54"S 150°17'54"E, 161–184 m, RV *Southern Surveyor*, benthic sled, coll. P. B. Berents, 1 September 1994; AM P.101379, 3 mature males, 1 premature female, 1 juvenile, east of Disaster Bay, 37°19'24"S 150°11'18"E, 107–110 m, RV *Southern Surveyor*, benthic sled, coll. P. B. Berents, 1 September 1994; AM P.101380, 1 mature male, east of Disaster Bay, 37°18'36"S 150°03'54"E, 81–82 m, RV *Southern Surveyor*, benthic sled, sediment, coll. P. B. Berents, 2 September 1994; AM P.101381, 2 mature females east of Disaster Bay, 37°18'42"S 150°00'48"E, 42–44 m, RV *Southern Surveyor*, benthic sled, coll. P. B. Berents, 2 September 1994; AM P.101382, 1 mature male east of Merimbula, 36°55'48"S 149°58'06"E, 43–44 m, RV *Southern Surveyor*, benthic sled, coll. P. B. Berents, 3 September 1994; AM P.101383, 1 mature female, east of Bermagui,

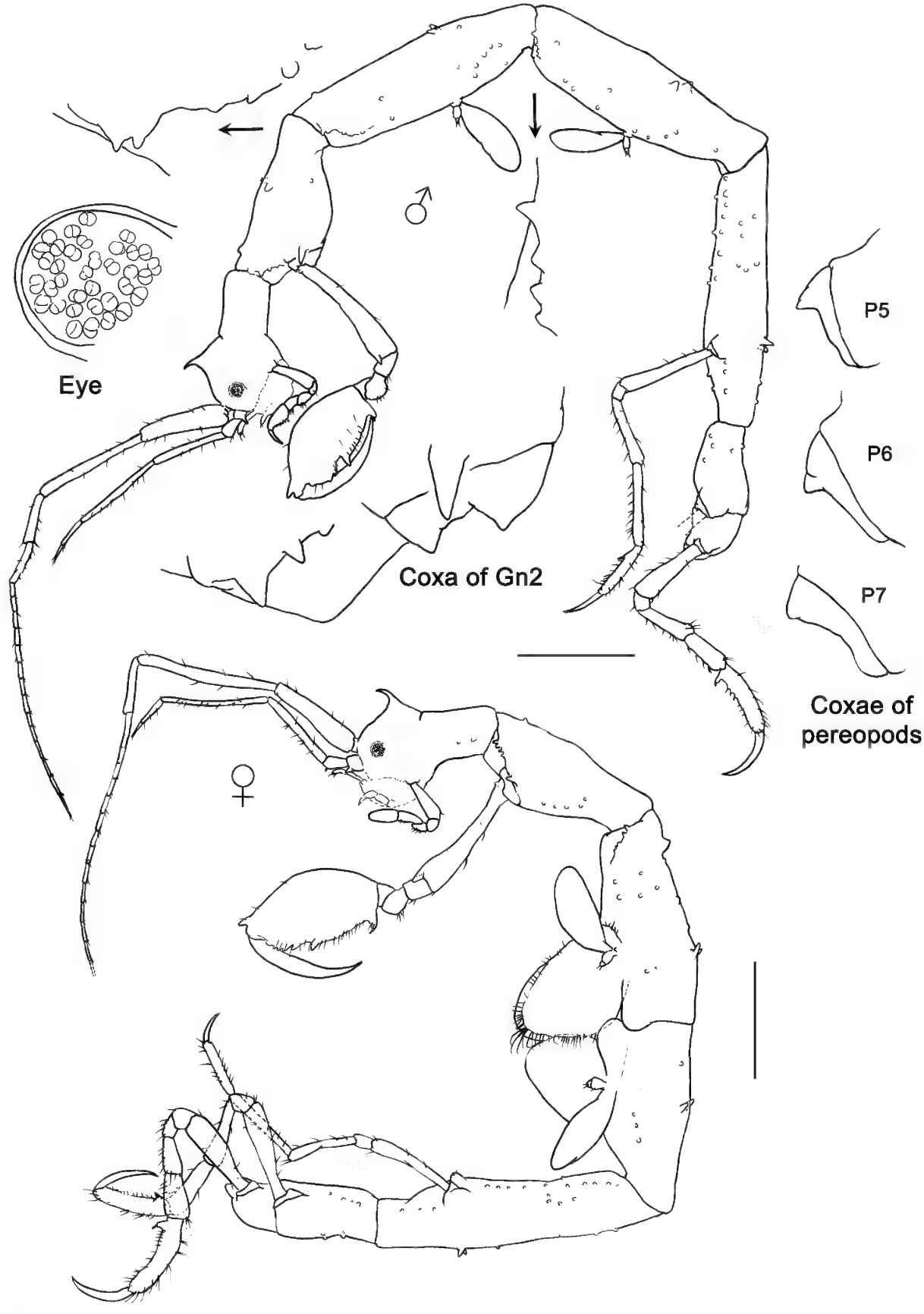

Figure 6. *Pseudoprotella australiensis* sp. nov. Lateral view of holotype male AM P.101359 and paratype "a" female AM P.101360. Details of eye, coxae of gnathopod 2 and pereopods and body tubercles ornamentation of the male are also included. Scale bars: 1 mm.

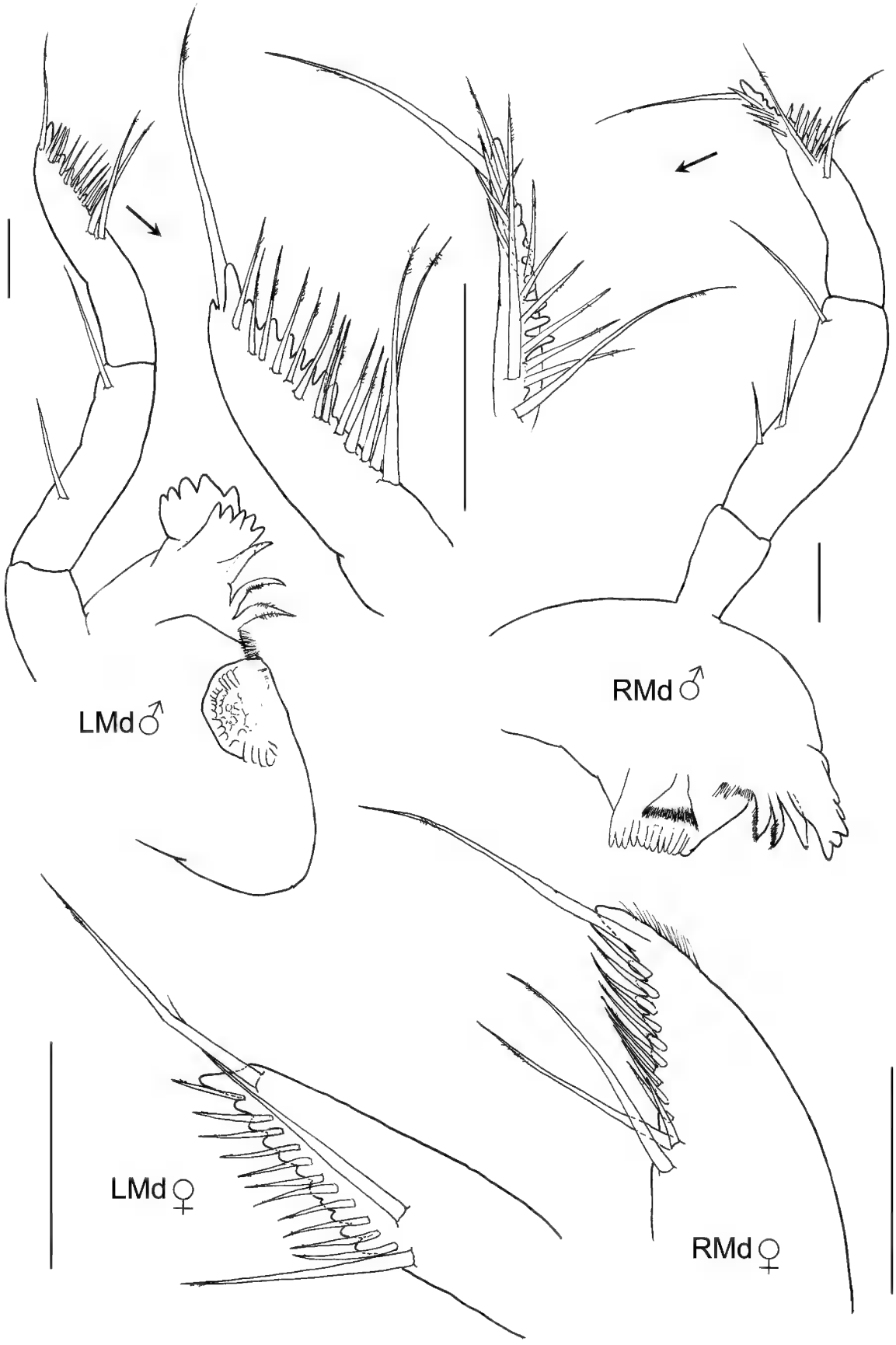

Figure 7. *Pseudoprotella australiensis* sp. nov. Mandibles of holotype male AM P.101359. Scale bars: 0.05 mm.

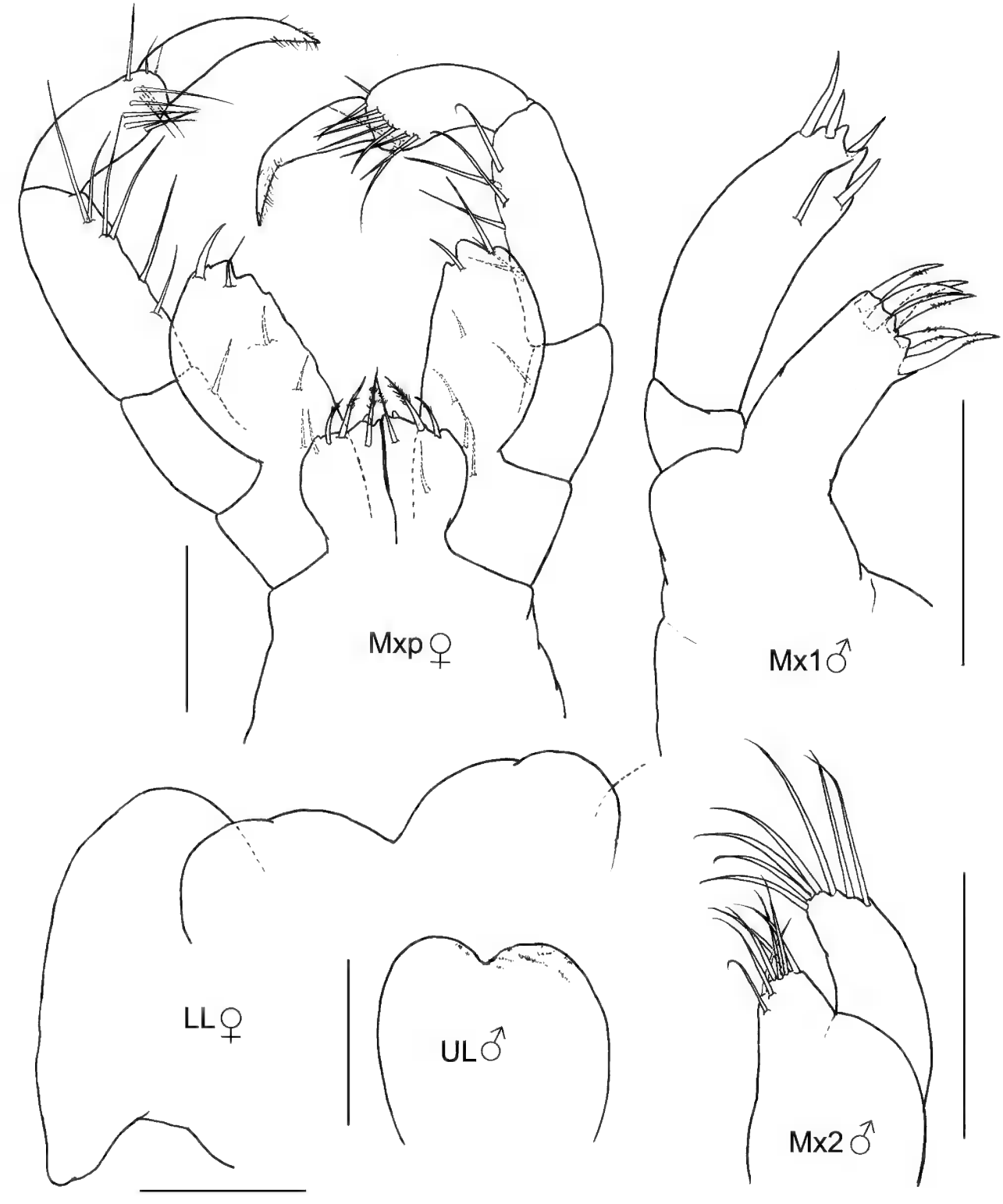

Figure 8. *Pseudoprotella australiensis* sp. nov. Maxilla 1, maxilla 2, upper lip of holotype male AM P.101359; maxilliped and lower lip of paratype "a" female AM P.101360. Scale bars: 0.1 mm.

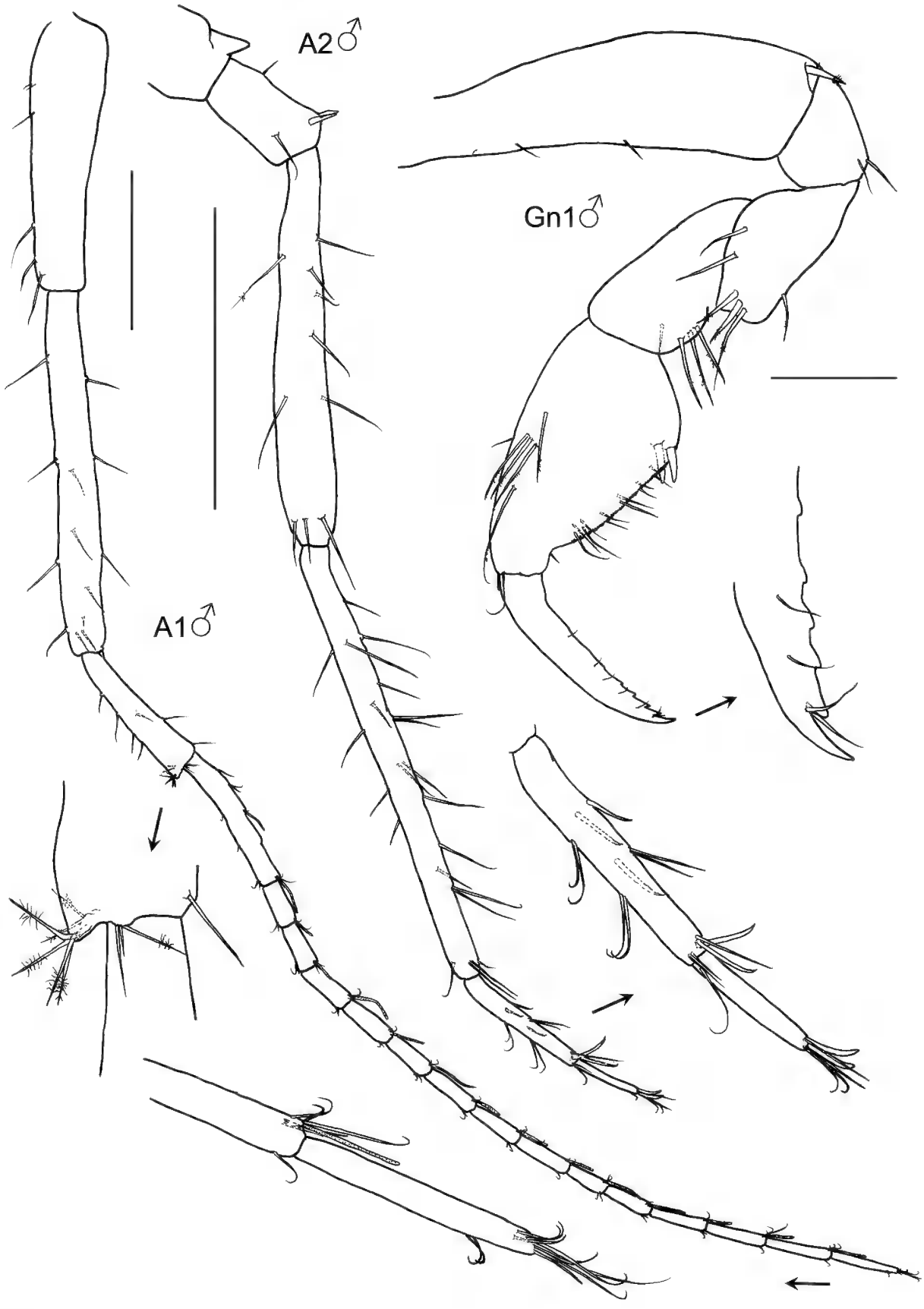

Figure 9. *Pseudoprotella australiensis* sp. nov. Antenna 1, antenna 2 and gnathopod 1 of holotype male AM P.101359. Scale bars: 1 mm (A1, A2), 0.1 mm (Gn1).

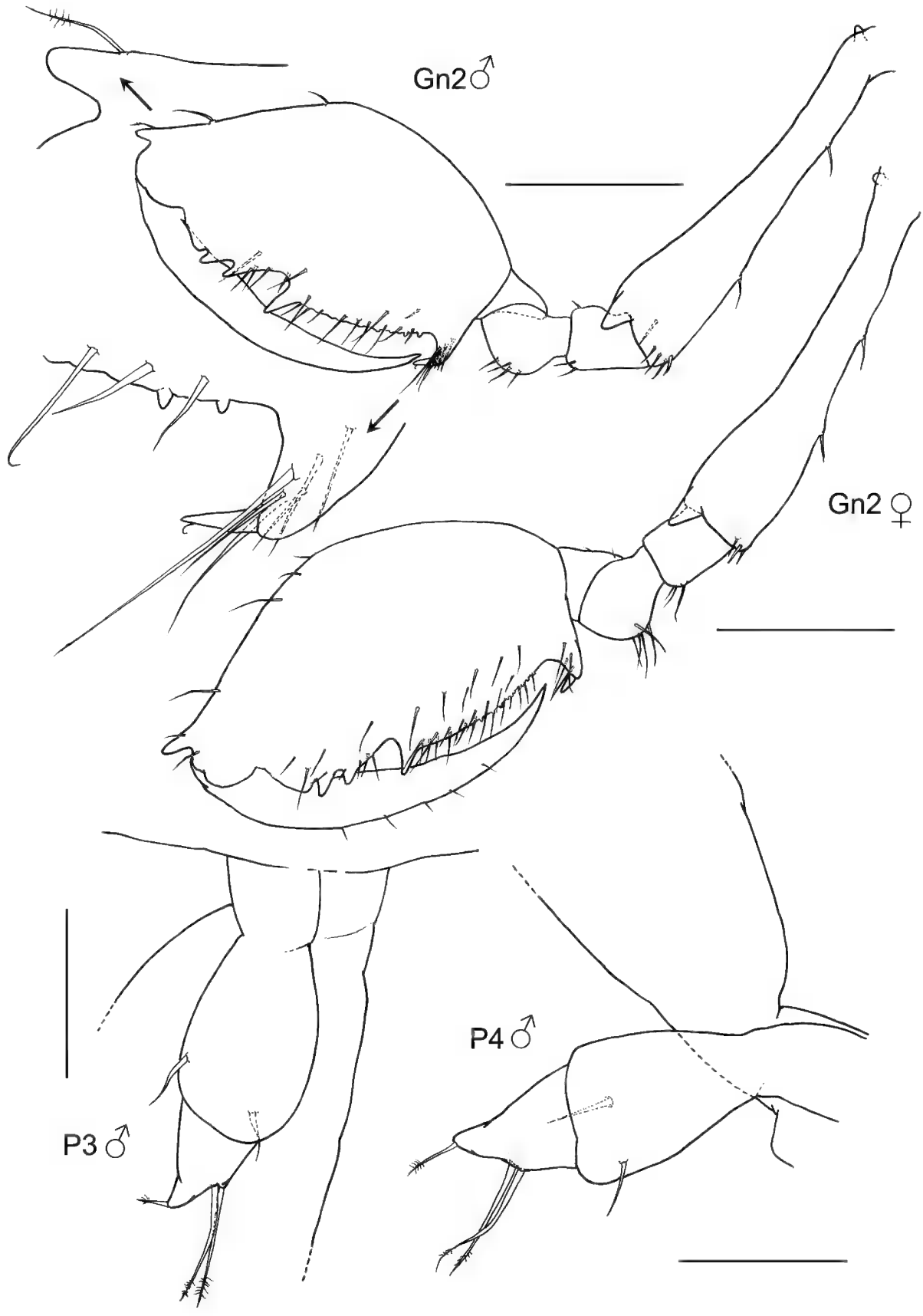

Figure 10. *Pseudoprotella australiensis* sp. nov. Gnathopod 2 and pereopods 3 and 4 of holotype male AM P.101359; gnathopod 2 of paratype "a" female AM P.101360. Scale bars: 0.5 mm (Gn2), 0.1 mm (P3, P4).

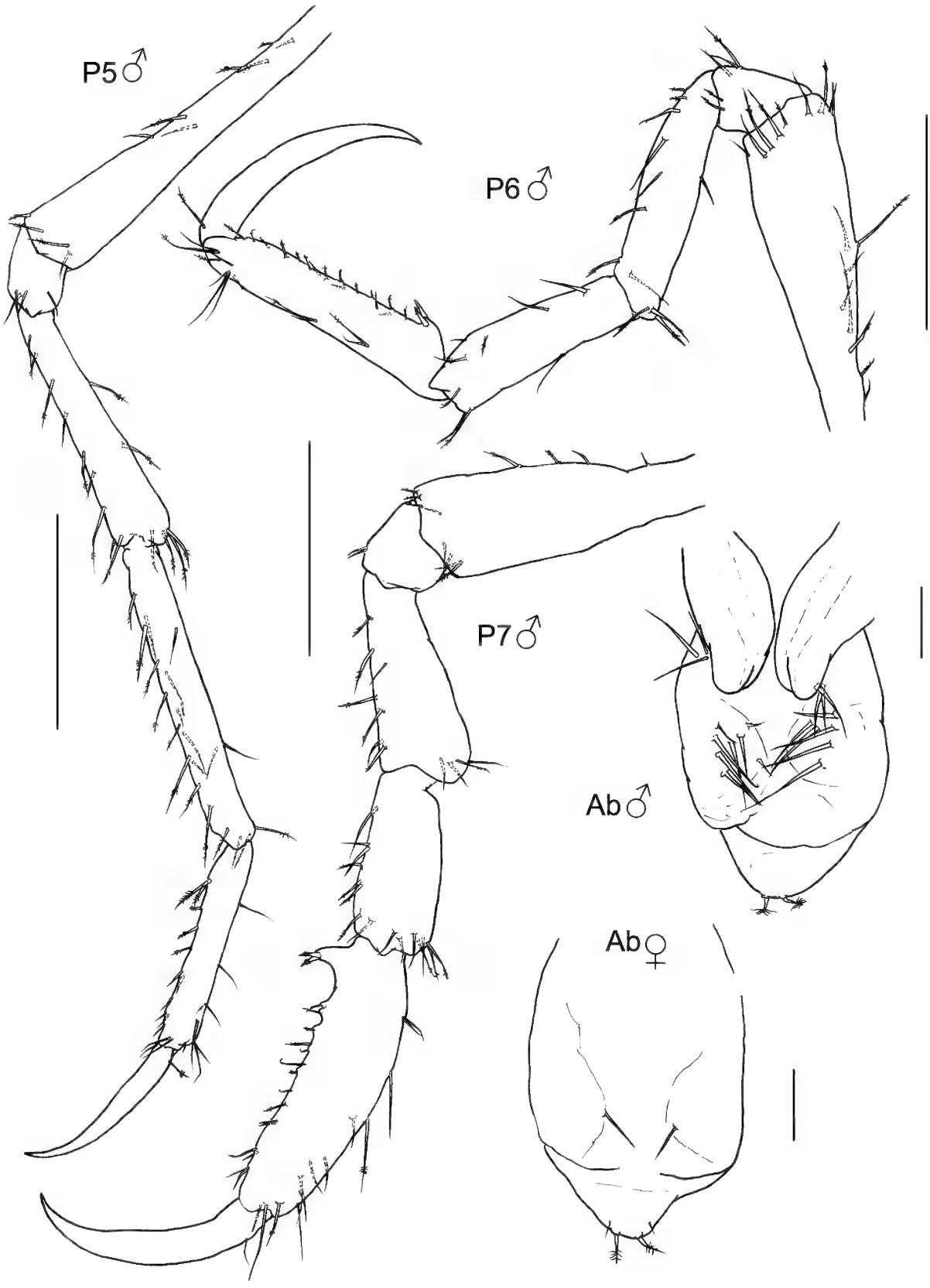

Figure 11. *Pseudoprotella australiensis* sp. nov. Pereopods 5, 6 and 7 and abdomen of holotype male AM P.101359; abdomen of paratype "a" female AM P.101360. Scale bars: 0.05 mm.

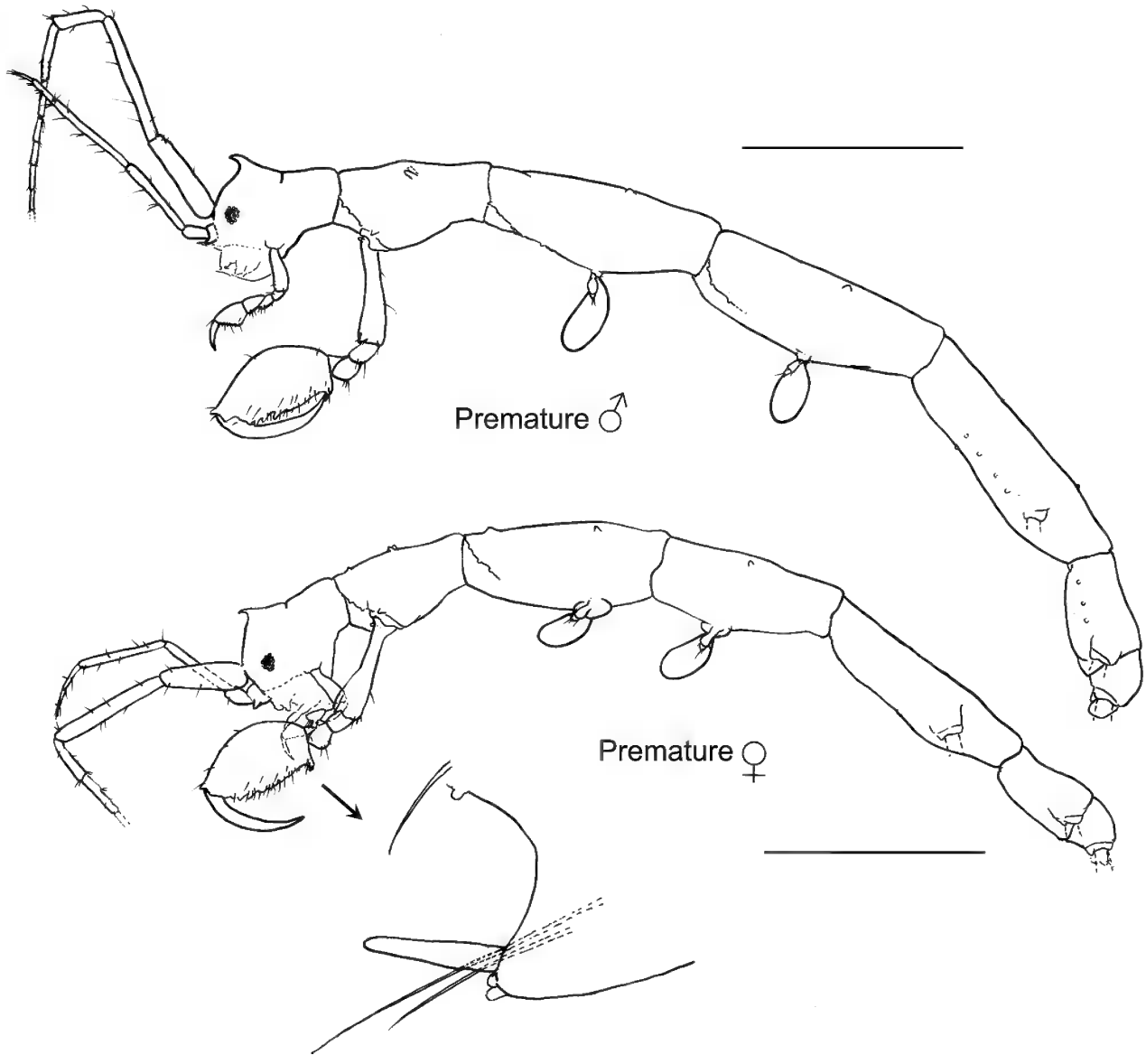

Figure 12. *Pseudoprotella australiensis* sp. nov. Lateral view of immature specimens: paratype "e" juvenile male AM P.101364 and paratype "f" premature female AM P.101365. Scale bars: 1 mm.

36°23'18"S 150°10'36"E, 76–79 m, RV *Southern Surveyor*, benthic sled, sediment, coll. P. B. Berents, 5 September 1994; AM P.101384, 2 mature females, east of Bermagui, 36°22'00"S 150°06'42"E, 26 m, RV *Southern Surveyor*, benthic sled, pebbles and coarse gravel, coll. P. B. Berents, 6 September 1994; AM P.101385, 1 mature female, east of Bermagui, 36°25'12"S 150°18'30"E, 220 m, RV *Southern Surveyor*, benthic sled, coll. P. B. Berents, 5 September 1994.

Victoria, Australia: AM P.101376, 1 mature male Bass Strait, east of Seal Islands, 38°59'06"S 148°31'36"E, 125 m, RV *Southern Surveyor*, benthic sled, 27 August 1994, coll. P. B. Berents; AM P.101377, 1 mature female, south of Gabo Island, 37°51'06"S 149°50'42"E, 130–131 m, RV *Southern Surveyor*, benthic sled, sponge, 31 August 1994, coll. P. B. Berents.

Tasmania, Australia: AM P.101375, 1 mature male, off St. Helens Point, 41°20'36"S 148°30'00"E, 110 m, RV *Sprightly*, fine clayey sand, preserved 80% ethanol, 25 March 1973, coll. P. H. Colman.

Etymology. The specific epithet "australiensis" alludes to the continent from which the species has been found, Australia.

Diagnosis. Eyes with distinctive ommatidia. Head with an anteriorly curved dorsal acute projection. Pereonites 2–6 with tiny tubercles scattered on the surface. Maxilliped palp article 3 without distal projection. Mandibular palp 3-articulate, with the setal formula 2-x-1, with x = 11; molar triturative, molar flake present. Maxilla 1 outer lobe with 6 distal spines. Gnathopod 2 basis shorter than pereonite 2. Pereopods 3 and 4 2-articulate; proximal article larger than distal article; distal article conical. Pereopods 5–7 6-articulate. Abdomen without appendages (no distinctive pleopods).

Description. *Holotype male* AM P.101359 (11.3 mm)

Lateral view (Fig. 6). Head with an anteriorly curved dorsal acute projection. Eyes with distinctive ommatidia. Pereonite 1 fused with head, suture present. Pereonites 2–6 with tiny tubercles scattered on surface. Pereonites 2–5 dorsal surface also with pair of rounded medial tubercles, slightly larger than those scattered on body surface. Pereonites 2 and 3 also with small proximal projection dorsally and row of small rounded projections laterally from head to coxa, and acute projection medially near coxa (see detail in Fig. 6). Pereonites 3 and 4 also ornamented with anterolateral row of small projections. Pereonite 5 the longest. Pereonite 7 smooth, the shortest.

Gills (Fig. 6). Present at middle of pereonites 3 and 4, elongate, length about 3 × width.

Mouthparts (Figs 7, 8). (Maxilla 1, maxilla 2, upper lip and mandibles figured and described from holotype male; maxilliped and lower lip figured and described from paratype "a" female). Mandibles with strong and triturative molar; palp 3-articulate; setal formula 2-x-1 with x=11, row of tubercles present near the base of setae (see details in Fig. 7); left mandible with incisor and lacinia mobilis 5-dentate, followed by 3 accessory blades; right mandible incisor 5-dentate, lacinia mobilis blade-like, followed by 2 more blades; molar flake present. Upper lip with very fine setulae. Lower lip without setae; inner lobes apparently with medial cleft but not clearly marked. Maxilla 1 outer lobe carrying 6 spines, palp 2-articulate, distal article with medial seta and 4 setae distally, together with 3 small distal teeth. Maxilla 2 inner lobe triangular, small; outer lobe rectangular, twice as large as inner lobe. Maxilliped inner plate small, length about 1/3 outer plate length, with 3 plumose setae and small tooth; outer plate with 3 setae; palp 4-articulate, article 4 curved distally and with row of tiny setulae.

Antennae (Figs 6, 9). Antenna 1 about 1/2 body length; flagellum 15-articulate, basal article 1, 3× length of article 2. Antenna 2 about 1/2 length of antenna 1; proximal peduncular article with acute gland cone distally; article 2 with 2 spines distally instead of setae; swimming setae absent; flagellum 2-articulate.

Gnathopods (Figs 6, 9, 10). Gnathopod 1 longer than ischium, merus and carpus combined; occlusal margin of propodus minutely serrated; 2 proximal grasping spines, dactylus bifid distally and provided with row of setulae. Gnathopod 2 inserted on anterior half of pereonite 2; coxa well developed (see detail in Fig. 6); basis about 2/3 length of pereonite 2, provided with small proximal internal projection near coxa and distal projection laterally; ischium rectangular; merus rounded; carpus short and triangular; propodus with distal projection dorsally together with plumose seta; palm with proximal projection provided with large grasping spine, serrated area, medial projection, and 2 more projections distally (see Fig. 9); dactylus smooth, slightly curved.

Pereopods (Figs 6, 10, 11). Pereopod 3 and 4 2-articulate; basal article with 2 setae, distal article conical with 2 lateral plumose setae and distal seta. Pereopods 5–7 with well-developed coxae (see details of Fig. 6). Pereopod 5 inserted on distal end of pereonite 5, elongate, provided with abundant plumose setae and lacking defined grasping spines. Pereopods 6 and 7 more robust than pereopod 5, with plumose setae, palm of propodus with pair of stronger plumose setae appearing as grasping spines (on pereopod 7 these 2 setae are inserted on a proximal projection).

Penes (Fig. 11) large, situated laterally, cleft distally, elongate, length about 3× width.

Abdomen (Fig. 11) lacking appendages, a pair of lobes with cluster of setae, and single dorsal lobe with 2 plumose setae.

Paratype female "a" AM P.101359 (9.7 mm) (Figs 6, 8, 10, 11). Very similar to male apart from the presence of setose oostegites on pereonites 3 and 4, lack of penes, and lateral lobes of abdomen provided with single seta instead of a cluster of setae.

Intraspecific variation and ontogenetic development. Most of the morphological characters of the species are rather constant in all the specimens examined. Body dorsal tuberculation is similar in all the specimens, with the formula: Head+P1 (1), P2 (1+2), P3 (1+2), P4 (2), P5 (2), P6 (0), P7 (0) (number of tubercles in parentheses, except for Head+P1 where the number indicates acute projection). In some females, pereonite 2 lacks medial dorsal projections, and in some males, pereonite 4 also has a proximal projection as in pereonite 3. In connection with the mouthparts, the maxilla 1 outer lobe is always provided with six spines and the distal article of the palp carries four distal and one medial spine. Each lobe of maxilla 2 is provided with six to eight setae. The maxilliped inner plate is always provided with three setae, the inner two always being plumose, and the third, external, plumose in some specimens and not plumose in others. This inner plate can have 1 or 2 small teeth, and the outer plate has 2 or 3 distal setae. The setal formula of mandibular palp is 2-x-1 (with x = 11 in all specimens examined), although some specimens have an additional long seta proximally which could be considered as 3-x-1.

Regarding ontogenetic development (Fig. 12), the flagellum of antenna 2 is always 2-articulate. The number of articles of the flagellum of antennae 1 increases with development. Pereonite 2 of immature males and females lacks the small proximal dorsal round projection, and dorsal tubercles of peronites 2–5 are less developed than in mature specimens. The number of tiny tubercles scattered on the body surface is also lower in immature individuals and the lateral ornamentation on the proximal part of pereonites 2, 3 and 4 is less developed. The gnathopod 2, rather similar in males and females, does not change significantly during development; the distal dorsal projection of the propodus is already present in immature specimens. In adults of both sexes, gills of pereonites 3 and 4 are of the same length. In some larger males gills 3 become larger than gills 4.

Remarks. Four species of *Pseudoprotella* have been described so far: *Pseudoprotella phasma* (Montagu, 1804), *Pseudoprotella inermis* Chevreux, 1927 (redescribed by Guerra-García & Takeuchi, 2000), *Pseudoprotella soela* Guerra-García, 2004b and *Pseudoprotella bogisa* (Mayer, 1903), which was recently transferred from the genus *Noculacia* to *Pseudoprotella* mainly on the basis of the presence of a well developed molar, the structure of pereopods 3 and 4 and the setal formula of the mandibular palp being 2-x-1 (see Guerra-García, 2002). A comparison of *Pseudoprotella* spp. is provided by Guerra-García (2002). *Pseudoprotella inermis* is restricted to the Strait of Gibraltar area and North Atlantic coast of Morocco (Guerra-García & Takeuchi, 2000; Guerra-García *et al.*, 2014) and it is characterized by the total absence of dorsal body projections.

Pseudoprotella bogisa has been collected so far only from Thai waters (McCain & Steinberg, 1970; Guerra-García, 2002), and *Pseudoprotella soela* from Western Australia (Guerra-García, 2004b). *Pseudoprotella phasma sensu lato* is distributed in the Mediterranean Sea and Atlantic Ocean, and includes several forms (f. *typica*, f. *minor*, f. *quadrispinis* and f. *bispinis*) described by Mayer (1890, 1903) and two additional ones collected from deep-sea areas of the northwestern Iberian Peninsula and figured by Guerra-García *et al.* (2018). Hence, *P. phasma*, as presently understood, probably includes at least six different species, which are still awaiting proper description and/or new appraisal of species ranking. A full revision of *Pseudoprotella* with detailed morphological and molecular data is, therefore, mandatory to clarify the taxonomical status of *P. phasma sensu lato* from shallow waters of the Mediterranean and Atlantic (Guerra-García *et al.*, 2018).

The new species, *P. australiensis*, can be differentiated from all the remaining species of *Pseudoprotella* mainly on the basis of the unique body ornamentation (acute projection on the head, pereonites with abundant tiny tubercles scattered on the surface, and rows of lateral tubercles on the proximal end of pereonites 2–4). The new species is closer to *P. bogisa* than to remaining species, mainly on the basis of the following characters: (i) distal article of pereopods 3 and 4 is conical and smaller than proximal one in *P. australiensis* and *P. bogisa* while it is not conical in *P. soela* and it is oval-rectangular and larger than the proximal one in *P. phasma* and *P. inermis*; (ii) maxilla 1 outer lobe is provided with 6 strong spines in *P. bogisa* and *P. australiensis*, while the remaining species have only 5 strong spines. A female of *Pseudoprotella* found in deep-sea water of Azores and figured by Guerra-García (2004a: 25, fig. 17) shows a combination of maxilla 1 with six strong spines and pereopods 3 and 4 with distal articles larger than proximal ones. This, together with the presence of two undescribed forms found in deep-sea Galician waters of the northwestern Iberian Peninsula indicates that a detailed study of *P. phasma sensu lato* from deep-sea waters of the Mediterranean and Atlantic Ocean is necessary to clarify the taxonomical status of the species of *Pseudoprotella*.

The new species, *P. australiensis*, seems to be abundant in mesophotic and deep-sea waters of southeastern Australia including New South Wales, Victoria and Tasmania from 56 to 1125 m depth. Although there are no ecological data accompanying most of the samples, the species has been collected mainly from sediments (fine clayey sand, pebbles and coarse gravel) and sponges.

Acknowledgments. The present study was funded by a grant "Salvador Madariaga" of the "Ministerio de Ciencia, Innovación y Universidades". Special thanks to our colleagues of the Australian Museum, Marine Invertebrates Department, for hospitality and help during the study.

References

Abesamis, R. A., T. Langlois, M. Birt, E. Thillainath, A. A. Bucol, H. O. Arceo, and G. R. Russ. 2018. Benthic habitat and fish assemblage structure from shallow to mesophotic depths in a storm-impacted marine protected area. *Coral Reefs* 37(1): 81–97. https://doi.org/10.1007/s00338-017-1635-0

Baldwin, C. C., L. Tornabene, and D. R. Robertson. 2018. Below the mesophotic. *Scientific reports* 8(1) : 4920. https://doi.org/10.1038/s41598-018-23067-1

Bell, J. J., J. Jompa, A. Haris, S. Werorilangi, M. Shaffer, and C. Mortimer. 2018. Domination of mesophotic ecosystems in the Wakatobi Marine National Park (Indonesia) by sponges, soft corals and other non-hard coral species. *Journal of the Marine Biological Association of the United Kingdom* 99(4): 771–775. https://doi.org/10.1017/S0025315418000917

Englebert, N., P. Bongaerts, P. R. Muir, K. B. Hay, M. Pichon, and O. Hoegh-Guldberg. 2017. Lower mesophotic coral communities (60–125 m depth) of the northern Great Barrier Reef and Coral Sea. *PLoS ONE* 12: e0170336. https://doi.org/10.1371/journal.pone.0170336

Farrelly, C. A., and S. T. Ahyong. 2019. Deepwater decapod, stomatopod and lophogastrid Crustacea from Eastern Australia and the Great Australian Bight collected in 2015–2017: preliminary identifications of 191 species. *Museum Victoria Science Reports* 21: 1–97. https://doi.org/10.24199/j.mvsr.2019.21

Guerra-García, J. M. 2002. Revision of the genus *Noculacia* Mayer, 1903 (Crustacea: Amphipoda: Caprellidea) with the description of two new species. *Organisms Diversity & Evolution* 2(4): 351–352. https://doi.org/10.1078/1439-6092-00055

Guerra-García, J. M. 2003. Two new species of deep-water caprellids (Crustacea: Amphipoda) from northeastern Brazil. *Cahiers de Biologie Marine* 44: 171–184.

Guerra-García, J. M. 2004a. Deep-sea Caprellidea (Crustacea: Amphipoda) from Azores with the description of three newspecies. *Zoosystema* 26(2): 235–262.

Guerra-García, J. M. 2004b. The Caprellidea (Crustacea, Amphipoda) from Western Australia and Northern Territory, Australia. *Hydrobiologia* 522: 1–74. https://doi.org/10.1023/B:HYDR.0000029929.07691.a7

Guerra-García, J. M., T. Chatterjee, and N. V. Schizas. 2015. New genus and new species of Caprellidae (Crustacea: Peracarida: Amphipoda) from the mesophotic coral ecosystems of Puerto Rico and St. Croix, Caribbean Sea. *Zootaxa* 4018(1): 80–96. https://doi.org/10.11646/zootaxa.4018.1.4

Guerra-García, J. M., and E. A. Hendrycks. 2013. A new species of *Liropus* (Crustacea, Amphipoda, Caprellidae) from California, USA, with an illustrated key of the genus. *Zootaxa* 3718: 467–476. https://doi.org/10.11646/zootaxa.3718.5.3

Guerra-García, J. M., B. Iazaa, and C. Megina. 2014. Vertical distribution of caprellids (Crustacea: Amphipoda) associated to hydroids, with the first record of *Pseudoprotella inermis* for Morocco. *Zoologica Baetica* 25: 65–73.

Guerra-García, J. M., S. J. Keable, and S. T. Ahyong. 2020. A new species of *Paraproto* (Crustacea: Amphipoda) from southern New South Wales, Australia. *Zootaxa* 4755: 271–293. https://doi.org/10.11646/zootaxa.4755.2.4

Guerra-García, J. M., and I. Takeuchi. 2000. Redescription of *Pseudoprotella inermis* Chevreux, 1927, a rare species of caprellidean amphipod (Crustacea) from Ceuta, North Africa. *Proceedings of the Biological Society of Washington* 113: 980–988.

Guerra-García, J. M., R. Tato, and J. Moreira. 2018. Caprellidae (Crustacea: Peracarida: Amphipoda) from deep-sea waters off Galicia (NW Iberian Peninsula) with the description of a new genus and three new species. *Zootaxa* 4532(2): 151–202. https://doi.org/10.11646/zootaxa.4532.2.1

Hinderstein, L., J. Marr, F. Martinez, M. Dowgiallo, K. Puglise, R. Pyle, D. Zawada, and R. Appeldoorn. 2010. Theme section on "Mesophotic Coral Ecosystems: Characterization, Ecology, and Management." *Coral Reefs* 29: 247–251.
https://doi.org/10.1007/s00338-010-0614-5

Horowitz, J., D. M. Opresko, and T. Bridge. 2018. Black corals (Anthozoa: Antipatharia) from the deep (916 m–2542 m) Coral Sea, north-eastern Australia. *Zootaxa* 4472(2): 307–326.
https://doi.org/10.11646/zootaxa.4472.2.5

Laubitz, D. R. 1972. *The Caprellidae (Crustacea, Amphipoda) of Atlantic and Arctic Canada*. Ottawa: National Museum of Natural Sciences Publications in Biological Oceanography, 82 pp.

Laubitz, D. R., and E. L. Mills. 1972. Deep-sea Amphipoda from the western North Atlantic Ocean. Caprellidea. *Canadian Journal of Zoology* 50: 371–383.
https://doi.org/10.1139/z72-054

Lowry, J. K., and A. A. Myers. 2013. A phylogeny and classification of the Senticaudata subord. nov. (Crustacea: Amphipoda). *Zootaxa* 3610: 1–80.
https://doi.org/10.11646/zootaxa.3610.1.1

Lowry, J. K., and A. A. Myers. 2017. A phylogeny and classification of the Amphipoda with the establishment of the new order Ingolfiellida (Crustacea: Peracarida). *Zootaxa* 4265: 1–89.
https://doi.org/10.11646/zootaxa.4265.1.1

Lowry, J. K., and H. E. Stoddart. 2010. The deep-sea scavenging genus *Hirondellea* (Crustacea: Amphipoda: Lysianassoidea: Hirondelleidae fam. nov.) in Australian waters. *Zootaxa* 2329(1): 37–55.
https://doi.org/10.11646/zootaxa.2329.1.3

MacIntosh, H., F. Althaus, A. Williams, J. E. Tanner, P. Alderslade, S. T. Ahyong, N. J. Bax, F. Criscione, A. L. Crowther, C. A. Farrelly, J. K. Finn, L. Goudie, K. L. Gowlett-Holmes, A. M. Hosie, E. K. Kupriyanova, C. Mah, A. W. McCallum, K. L. Merrin, A. Miskelly, M. L. Mitchell, T. Molodtsova, A. Murray, T. D. O'Hara, P. M. O'Loughlin, H. Paxton, A. L. Reid, S. J. Sorokin, D. A. Staples, G. Walker-Smith, E. Whitfield, and R. S. Wilson. 2018. Invertebrate diversity in the deep Great Australian Bight (200–5000 m). *Marine Biodiversity Records* 22: 23.
https://doi.org/10.1186/s41200-018-0158-x

Mauro, F. D. M., and C. S. Serejo. 2015. The family Caprellidae (Amphipoda: Caprelloidea: Caprellidae) from Campos Basin, southwestern Atlantic, with a key of species occurring in Brazil. *Zootaxa* 4006(1): 103–127.
https://doi.org/10.11646/zootaxa.4006.1.5

Mayer, P. 1890. Die Caprelliden des Golfes von Neapel und der angrenzenden Meeres-Abschnitte. *Nachtrag zur Monographie derselben. Fauna und Flora des Golfes von Neapel* 17: 1–157.
https://doi.org/10.5962/bhl.title.53624

Mayer, P. 1903. Die Caprellidae der Siboga-Expedition. *Siboga-Expeditie* 34: 1–160.
https://doi.org/10.5962/bhl.title.53742

McCain, J. C., and J. E. Steinberg. 1970. *Crustaceorum Catalogus: Amphipoda I, Caprellidea I, Family Caprellidae*. Den Haag: Dr W. Junk N.V., 78 pp.

Petrescu, I., T. Chatterjee, and N. V. Schizas. 2012. New genus and new species of Cumacea (Crustacea: Peracarida) from the mesophotic coral ecosystem of SW Puerto Rico, Caribbean Sea. *Zootaxa* 3476: 55–61.
https://doi.org/10.11646/zootaxa.3476.1.2

Ramirez-Llodra, E., P. A. Tyler, M. C. Baker, O. A. Bergstad, M. R. Clark, E. Escobar, L. Levin, L. Menot, A. A. Rowden, C. R. Smith, and C. L. Van Dover. 2011. Man and the last great wilderness: human impact on the deep sea. *PLoS ONE* 6(8): e22588.
https://doi.org/10.1371/journal.pone.0022588

Sánchez-Moyano, J. E., I. García-Asencio, and J. M. Guerra-García. 2015. Littoral caprellids (Crustacea: Amphipoda) from the Mexican Central Pacific coast, with the description of four new species. *Journal of Natural History* 49: 77–127.
https://doi.org/10.1080/00222933.2014.937366

Senna, A. R., R. Sorrentino, T. Chatterjee, and N. V. Schizas. 2014. A new species of *Boca* Lowry & Stoddart, 1997 (Amphipoda: Lysianassoidea: Aristiidae) from a mesophotic coral ecosystem off Puerto Rico, Caribbean Sea. *Zootaxa* 3884(5): 429–436.
https://doi.org/10.11646/zootaxa.3884.5.3

Takeuchi, I. 2015. A new species of *Paraproto* (Crustacea: Amphipoda: Phtisicidae) collected from the South Shetland Islands, Antarctica. *Polar Science* 9: 368–373.
https://doi.org/10.1016/j.polar.2015.08.002

Takeuchi, I., K. Tomikawa, and D. Lindsay. 2016. A new genus and species of Phtisicidae (Crustacea: Amphipoda) from abyssal depths in the Japan Trench, with special reference to similarities with Southern Ocean Genera. *Journal of Crustacean Biology* 36: 495–506.
https://doi.org/10.1163/1937240X-00002457

Tanner, J. E., F. Althaus, S. J. Sorokin, and A. Williams. 2018. Benthic biogeographic patterns in the southern Australian deep sea: Do historical museum records accord with recent systematic, but spatially limited, survey data? *Ecology and Evolution* 8(23): 11423–11433.
https://doi.org/10.1002/ece3.4565

Thistle, D. 2003. The deep-sea floor: an overview. In *Ecosystems of the World*, volume 28, pp. 5–39, of *Ecosystems of the Deep Ocean*, ed. P. A. Tyler. Amsterdam: Elsevier.

Turner, J. A., R. C. Babcock, R. Hovey, and G. A. Kendrick. 2018. AUV-based classification of benthic communities of the Ningaloo shelf and mesophotic areas. *Coral Reefs* 37(3): 763–778.
https://doi.org/10.1007/s00338-018-1700-3

Weinstein, D. K., T. B. Smith, and J. S. Klaus. 2014. Mesophotic bioerosion: variability and structural impact on US Virgin Island deep reefs. *Geomorphology* 222: 14–24.
https://doi.org/10.1016/j.geomorph.2014.03.005

Williams, A., F. Althaus, H. MacIntosh, M. Loo, K. Gowlett-Holmes, J. E. Tanner, and M. Green. 2018. Characterising the invertebrate megafaunal assemblages of a deep-sea (200–3000 m) frontier region for oil and gas exploration: the Great Australian Bight, Australia. *Deep Sea Research Part II: Topical Studies in Oceanography* 157: 78–91.
https://doi.org/10.1016/j.dsr2.2018.07.015

Wilson, G. D. F. 2005. *Arafura Sea Biological Survey. Report on RV Southern Surveyor Expedition 05/2005*. Unpublished voyage summary (prepared for the Department of the Environment and Heritage-National Oceans Office by the Australian Museum, 17 pp.

Woodall, L. C., D. A. Andradi-Brown, A. S. Brierley, M. R. Clark, D. Connelly, R. A. Hall, K. L. Howell, V. A. I. Huvenne, K. Linse, R. E. Ross, P. Snelgrove, P. V. Stefanoudis, T. T. Sutton, M. Taylor, T. F. Thornton, and A. D. Rogers. 2018. A multidisciplinary approach for generating globally consistent data on mesophotic, deep-pelagic, and bathyal biological communities. *Oceanography* 31(3): 76–89.
https://doi.org/10.5670/oceanog.2018.301

Zettler, M. L., A. Freiwald, and J. M. Guerra-García. 2018. Cold-water corals off Angola as refuge for a new *Aeginella* species (Crustacea: Amphipoda: Caprellidae). *Zootaxa* 4462(4): 535–546.
https://doi.org/10.11646/zootaxa.4462.4.6

INSTRUCTIONS TO AUTHORS

Manuscripts must be submitted to the Editor. All manuscripts are refereed externally. Members of the Editorial Committee oversee the peer-review process and establish publication standards.

Only those manuscripts that meet the following requirements will be considered for publication.

Submit manuscripts and images separately and electronically; images should be high resolution TIFF or PSD (see below). Attach one summary file giving: the title; the name, address, email and ORCID of each author; the author responsible for checking proofs; a suggested running-head of less than 40 character-spaces; and the number of figures, tables and appendices. Manuscripts must be complete when submitted.

Tables and figures should be numbered and referred to in numerical order in the text. Authors should avoid excessive layout or textual embellishments.

All copy is manipulated within a Windows (not Mac) environment using Microsoft and Adobe software. Maps should be submitted as high resolution TIFF or PSD.

Manuscripts should be prepared using recent issues as a guide. There should be a title (series titles should not be used), author(s) with their institutional addresses, an abstract (should be intelligible by itself, informative not indicative), introduction (should open with a few lines for general, non-specialist readers), materials and methods, results (usually subdivided with primary, secondary and rarely tertiary-level headings), discussion, acknowledgments and references. If appropriate, an appendix may be added after references.

In the titles of zoological works the higher classification of the group dealt with should be indicated. Except for common abbreviations, definitions should be given in the materials and methods section. Sentences should not begin with abbreviations or numerals; generic names should not be abbreviated if at the beginning of a sentence. Metric units must be used except when citing original specimen data. It is desirable to include geospatial coordinates; when reference is made to them, authors must ensure that their format precludes ambiguity, in particular, avoid formats that confuse arcminutes and arcseconds.

Label and specimen data should, as a minimum requirement, indicate where specimens are deposited, in addition to locality, date and collector. Original specimen data—especially that of type material—is preferred over interpreted data. If open to interpretation, cite original data between quotation marks or use "[sic]".

Rules of the International Code of Zoological Nomenclature must be followed; authors must put a very strong case if a Recommendation is not followed. When new taxa are proposed in works having multiple authors, the identity of the author(s) responsible for the new name(s) and for satisfying the criteria of availability, should be made clear in accordance with Recommendations in Chapter XI of the Code. A scientific name with more than two authors is unwieldy and should be avoided. Keys are desirable; they must be dichotomous and not serially indented. Synonymies should be of the short form: taxon author, year, pages and figures. A period and em-dash must separate taxon and author, except in the case of reference to the original description. Proposed type material should be explicitly designated and, unless institutional procedure prohibits it, registered by number in an institutional collection.

Previously published illustrations will generally not be accepted. Colour is acceptable but only where necessary. All images must (*a*) be rectangular or square and scalable to a width of 83 mm (= one text column) or 172 mm (= both text columns including central gutter) and any depth up to 229 mm (the number of lines in a caption limits depth); (*b*) have lettering similar to 14 pt, upper case, regular, *sans serif*, Helvetica or Arial, in final print; (*c*) have no unnecessary white or black space; and (*d*) have vertical or horizontal scale bar(s), with the thickness approximately equal to an upper case 14 pt letter "I".

Digital images must be presented as TIFF, or as multilayered PSD files suitable for *Adobe Photoshop*. Halftone and colour images must be at a minimum resolution of 300 dpi at final size (at this resolution 2040 pixels = printed page width = 172 mm) and all labelling must be sharp (with *anti-alias* active). Black and white line images (bitmaps) must be at a minimum resolution of 1200 dpi at final size (at this resolution, 8130 pixels = printed-page width).

When reference is made to figures in the present work use Fig. or Figs, when in another work use fig. or figs; the same case-rule applies to the words *tables*. Figures and tables should be numbered and referred to in numerical order in the text.

Authors should refer to recent issues of the *Records of the Australian Museum* to determine the correct format for listing references and to *The Chicago Manual of Style* to resolve other matters of style. If *EndNote* is used, *Chicago 16th B* (author-date) closely approaches the required specification. *CrossRef*-minted DOIs are inserted automatically during copyediting (see crossref.org/SimpleTextQuery/); DOIs minted by other agencies (e.g., *DataCite*, etc.) should be entered by authors.

Certain anthropological manuscripts (both text and images) may deal with culturally sensitive material. Responsibility rests with authors to ensure that approvals from the appropriate person or persons have been obtained prior to submission of the manuscript.

Stratigraphic practice should follow the *International Stratigraphic Guide* (second edition) and *Field Geologist's Guide to Lithostratigraphic Nomenclature in Australia*.

The Editor and Publisher reserve the right to modify manuscripts to improve communication between author and reader. Essential corrections only may be made to final proofs. No corrections can be accepted less than 10 days prior to publication without cost to the author(s). All proofs should be returned as soon as possible.

No duplicates or reprints are printed.

All authors, or the Corresponding Author on their behalf, must sign a *Licence to Publish* when a manuscript is submitted, and certify that the research described has adhered to the Australian Museum's *Guidelines for Research Practice*—or those of their home institution providing they cover the same issues, especially with respect to authorship and acknowledgment. While under consideration, a manuscript may not be submitted elsewhere.

More information and examples are freely available at our website:

https://doi.org/10.3853/issn.2201-4349

Editor, *Records of the Australian Museum*

Australian Museum Research Institute

Australian Museum, 1 William Street, Sydney NSW 2010, Australia

editor@austmus.gov.au

Australian Museum Research Institute
1 William Street, Sydney NSW 2010
scientific publications freely accessible at
https://doi.org/10.3853/issn.2201-4349
ISSN 0067-1975 (print) 2201-4349 (online)